Psychological Bulletin

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Psychological Bulletin

THE ROLE OF THE STIMULUS IN RORSCHACH RESPONSES[1]

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The use of inkblots to analyze personality represents a creative effort of Hermann Rorschach, a man trained in medicine and a practicing psychiatrist. A similar statement can, of course, be made with regard to Freud and psychoanalytic theory. The subsequent histories of both of these creative efforts, however, have emphasized their essentially psychological natures and it is with general psychological principles that both must ultimately make their peace. Tremendous efforts, with this objective in mind, have been made in recent years by both psychologists and psychoanalysts interested in psychoanalytic theory. Individuals working with the Rorschach technique have become aware recently of quite similar pressures and have begun to respond in constructive fashion to such demands. Although it is not our purpose to analyze these forces, it should be noted that many of the same criticisms are directed against the Rorschach technique which in the past have been leveled against psychoanalytic theory. Perhaps more than anything else these trends reflect an increasing concern with the need to construct a unified behavior theory that encompasses behavior wherever it is found, be it on the analytic couch, in the animal laboratory, or in response to a series of amorphous inkblots. Recognizing the need to bring Rorschach theory into a closer relationship with general psychological principles, this article presents a review and evaluation of studies which have been carried out in an attempt to clarify the perceptual basis of the Rorschach technique.

[1] This article was developed as part of a project supported by grant M-1027 from the United States Public Health Service.

PERCEPTUAL THEORY AND RORSCHACH THEORY

A large portion of general psychological theory has been built upon the assumption that one must somehow relate observed behavior to the critical aspects of the stimulating situation in which the behavior is evoked. Put in other terms, certain stimuli lead to particular responses, and it is one of psychology's major tasks to discover these relationships at an empirical level and then integrate these findings so as to formulate general psychological principles or laws. A primary objective for psychology thus becomes the discovery of the stimulus for a given response, a principle elucidated by Dewey (**27**) a half-century ago in his famous discussion of the reflex arc, and underlined in recent discussions by Boring (**16**) and Zubin (**96**). Much of current-day behavior theory has been structured so as to be consistent with the spirit of this formulation, even though the

details of the different theories vary considerably. At an empirical level, acceptance of this principle has resulted in a multitude of research studies in which various aspects of the stimulus situation have been varied in order to observe their effects upon behavior. Each time that another such study appears in print one can see at least an implicit acknowledgment of the Dewey-Boring assertion that "a stimulus is not something given in research but something to be discovered by research" (**16**, p. 141).

In view of the fact that Thurstone (**92**) and others have criticized the Rorschach technique as being based upon principles not within the bounds of psychological science, it is perhaps startling and somewhat paradoxical to find that the core of the technique formulated by Rorschach rests upon a concern with a question quite identical with that which Dewey, Boring, and others acknowledge as being the primary task of psychology. To clarify this statement, one need only be reminded that the major responsibility of the examiner in a Rorschach testing situation is to discover what it is about the stimulus that evoked the response, i.e., discover the stimulus for the response. Early in his work Rorschach recognized that individuals were differentially sensitive to the several dimensions (e.g., form, color, shading) of the stimulus, and it was his major hypothesis that this differential sensitivity was in turn related to particular personality characteristics of the respondents. Thus if one could determine the attributes of the blots to which an individual had responded, he would then be in a position to infer the existence of certain personality traits. The inquiry was the means by which the examiner proceeded in his attempt to clarify the determinants of the responses. "What about the blot made you think of ———?" is a question that all experienced users of the technique have repeated almost ad infinitum.

In light of these facts then, why is the Rorschach considered to be outside the bounds of psychological science by many psychologists? Obviously no single answer will suffice to a question such as this, but three considerations do stand out. The first involves the fact that many observers recognize a close affinity between psychoanalytic theory and the type of thought brought to bear on a Rorschach protocol, an affinity given clearest expression in the recent work of Schafer (**82**). To some of these observers, psychoanalytic thinking has never settled very well in the digestive tract, and these attitudes find rather easy transfer to an evaluation of the Rorschach technique and preclude a reasonably objective appraisal. A second consideration revolves around the fact that many psychologists pride themselves on the quantitative nature of their science and eschew anything which smacks of subjectivity. The difficulties in dealing quantitatively with many aspects of Rorschach performance are too well known to bear repeating here. At the same time, however, it should be noted that increased sophistication in quantitative techniques is beginning to provide procedures to overcome some of the major problems in this regard (**25**).

The third consideration (and the one which is the focal point of this article) turns upon the relationship between Rorschach theory and perceptual theory. Ultimately, of course, there cannot be one theory of perception which applies to the Rorschach and another theory which applies to extra-Rorschach situations. Rorschach thought of his technique as

being fundamentally perceptual in nature, and it was with the formal properties of the response or how the response came about that he was most deeply concerned. Despite this early formulation of the theoretical basis for the technique, and despite the fact that this emphasis upon the structural aspects of the response has continued until very recent years, it nevertheless remains true that Rorschach theory and orthodox psychological theories of perception have made little contribution to one another. As a matter of fact one must search for communication, let alone contribution.

By looking more intensively at historical trends it is possible to discern a basis for this failure to mutually enrich. Psychologists interested in the classical laboratory problems of perception typically went about their work by introducing variations into the stimulus input and correlating these variations with the behavioral output. The *S*s in such experiments were merely means to an end, and it was usually the hope that they were somehow representative of people in general. Little or no attention was given to the needs, wishes, drives, and similar variables resident within the *S*. Over in the area of Rorschach work quite a different situation existed, for here the focus was upon the individual as an individual, with motivational variables being of central concern. Hundreds of investigations were reported in the literature in which *S*s with different personal characteristics were studied in their response to the Rorschach blots, but it was not until 1948 that research was reported in which there had been carried out an experimental manipulation of one of the properties of the Rorschach blots (**50**). Since that time 24 additional studies of this type have appeared (6 unpublished), but that they only begin to scratch the surface is indicated by Hutt's recent statement that " . . . very little work has as yet been done on the theoretical import of the nature of the stimulus material itself" (**42**, p. 199).[2] One thus finds that classical experimental work has been focused upon stimulus material (to the neglect of the perceiver) while Rorschach workers have been riveted to the perceiver (to the neglect of the stimulus material). Only in comparatively recent years have perceptual theorists given adequate recognition to the need for including both stimulus and *S* variables in a comprehensive theory of perception (**15**).

An early recognition of the need to unite perceptual theory and Rorschach theory may be found in the 1942 paper by Brosin and Fromm (**19**) in which they attempt to apply principles of Gestalt psychology to the Rorschach experiment. Bruner (**20**) presents a similar argument for union (without the Gestalt emphasis) in a more recent paper. The most detailed discussion of this problem may be found in the forthcoming volume by Zubin (**96**) who relies heavily upon the work of Gibson (**35**) in his analysis. Wertheimer (**94**) has also published an interesting discussion of perception and the Rorschach. The concern here, however, will not be primarily with these theoretical discussions but rather with the question of what the empirical research studies to date have to offer in terms of furthering our understanding of the role of the stimulus in Rorschach responses.

To prevent confusion, the reader should recognize that when reference is made to the stimulus or stimuli

[2] The paucity of such research becomes evident when one finds that more than 2,500 research articles and books have been published on the Rorschach to date (**48**).

the Rorschach blot(s) are intended. What effects do the various properties of these blots have upon the *S*'s behavior? Does color somehow make a difference? Are variations in shading or brightness immaterial as far as the *S*'s responses are concerned? What about figure-ground contrast? Do small form areas within larger portions of the blot modify responsiveness in an appreciable manner? How do the blots compare with one another in terms of the problems they present to the *S*? Is the sequence of stimuli important in shaping behavior? These are the kinds of questions to which attention is directed. In so limiting the task, there is no intention to imply that the stimulus is just the blot; obviously it is more that that as recent research has demonstrated (**79**). Such variables as instructional set, examiner characteristics, and purpose of the testing are clearly part of the stimulus context for the *S*. It remains true, however, that the core of the stimulus for most *S*s is the blot, and this core needs to be understood more completely.

Primary attention will be devoted to those studies which have attempted to clarify the role of the stimulus through experimental manipulation of its properties, since, as noted above, this procedure is in direct keeping with classical experimental procedure. Chronologically, however, such research is of recent date. Following discussion of these studies, briefer mention will be made of other investigations which somewhat more indirectly contribute to clarification of the general problem.

Studies Involving Experimental Manipulation of Stimulus Properties

Boring provides a succinct rationale for these experiments with his statement that, " . . . the effective stimulus is not an object but a property of the stimulus-object, some crucial property that cannot be altered without changing the response . . . " (**16**, p. 144). Implied in this statement is the generally accepted notion that objects (including inkblots) are vested with a number of properties, and that one property of the object may be more instrumental than another property in directing response to that object. To determine if and how this is so the experimenter needs to vary the properties in question and note the resultant variations in behavioral response (if any) to the object.[3]

Table 1 presents a summary of the empirical studies which have been reported within the above methodological framework. The studies are listed in chronological order based upon publication date except for unpublished studies, which are listed according to date of completion.

Twenty of the 25 investigations listed in Table 1 are concerned with the effects of color; only the studies reported by Balloch, Barnett, Baughman, Belden and Baughman, and Grayson attempt to evaluate the effects of attributes other than color. This focus of research reflects the central role of color in Rorschach theory plus the relative ease with which suitable achromatic renditions of the standard blots may be constructed for research purposes. Shading also plays a central role in Rorschach theory, but the technical problem posed for the experimenter who desires to treat shading as an independent variable is much more formidable.

[3] In retrospect, one might argue that this type of research should have been carried out in the early formative years of work with the Rorschach. Had this been done, much of the confusion and controversy related to such concepts as "color-shock" and "gray-black shock" might have been avoided.

TABLE 1

STUDIES BASED UPON EXPERIMENTAL MANIPULATION OF RORSCHACH STIMULUS PROPERTIES

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Lazarus (**50, 51**)	To determine if color influences scoring categories other than those making direct use of color; to see if color shock is dependent upon color.	100 high school seniors (50 males). Ages: 16–21. X IQ (Otis): 103.	Group method. Standard and achromatic series in counterbalanced order six weeks apart to groups equated for age, sex, education, IQ.	1. Higher *S* and *F%* scores on achromatic series; special analysis indicates possibility of elevated *P* scores on achromatic. 2. Color shock indices do not depend upon color. 3. Presence or absence of color had little effect upon scoring categories.
Wallen (**93**)	To determine if liking of Cards 2, 3, 8, 9, 10 is affected by color.	419 males in military service (71 neurotics). Ages: 17–37. Education: 0–15 years.	Individual administration. *Ss* shown each of 10 cards and asked to tell if they liked it. 283 *Ss* shown standard series, 136 *Ss* shown achromatic series. 45 *Ss* asked to compare chromatic-achromatic versions of Cards 2, 3, 8, 9, 10.	1. Normals prefer colored version of 8, 9, 10, achromatic version of 3; no difference for 2. 2. Neurotics prefer 8, 10 in color, tend to prefer 9 in color; no difference for 3; tend to prefer achromatic 2. 3. The neurotics' dislike of 2 is related to their association of it with blood. 4. Color may produce shock because it facilitates associations with a disturbing effect; in general, however, contour and organization of blot are the primary determiners of affective reactions.
Reece (**72**)	To study influence of color on Rorschach protocol.	54 psychology students (44 males). Ages: 18–43.	Group administration. Standard and achromatic series administered to two groups ($N = 27$) equated for age, sex, and major area of study. No retesting. *Ss* also asked to indicate if they liked each card.	1. *D* responses more frequent (.01 level) and *W* responses less frequent (.05 level) on Cards 2, 3, 8, 9, 10 of standard series. 2. Form responses more frequent (.01 level) on Cards 2, 3, 8, 9, 10 of achromatic series. 3. Color did not affect "liking" of cards.

(*Continued on next page*)

TABLE 1—(*continued*)

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Sappenfield & Buker (78)	To determine if 8–10/*R*% is affected by color.	238 psychology students (153 males). $\bar{X}$ Age: 21. $\bar{X}$ Otis S–A: 60.	Group method. Standard and achromatic series administered in counterbalanced order one week apart to groups equated for age, sex, education, IQ.	1. Total *R* and 8–10/*R*% not affected by color.
Dubrovner, Von Lackum, & Jost (28)	To determine if productivity and reaction time are affected by color.	30 nurses. Ages: 18–34.	Individual administration. Standard and achromatic series in counterbalanced order. Average of two weeks between administrations.	1. Color does not affect productivity, 8–10/*R*%, or reaction time.
Siipola (84)	To determine influence of color on reaction time, emotional attitudes, rejections, and conceptual content.	132 college females.	Individual administration. Twenty colored areas cut from Rorschach blots and achromatic copies made. One group ($N=72$) responded to chromatic areas; second group ($N=60$) responded to achromatic. *Ss* also indicated like or dislike of each blot.	1. Color increases reaction time, frequency of both positive and negative emotional accompaniments of response, and number of rejections. 2. Whether content of response is affected depends upon whether the color is appropriate to the content suggested by the form of the blot.
Siipola, Kuhns, & Taylor (85)	To determine effects of color by administering chromatic and achromatic blots to same *Ss*.	98 college females.	Individual administration. Group C ($N=72$) responded to two series of blots (chromatic and achromatic). Group A ($N=26$) responded to two series of achromatic blots. Twenty blots in each series similar to forms used by Siipola (see above). One month between administrations.	1. Decreases in reaction times on second administration are traced to memory factor, not color. 2. Color alters conceptual content.
Barnett (8)	To study influence of color and shading.	40 psychology students (26 males). $\bar{X}$ Age: 21.	Individual administration. Two series of blots, standard and outline series. Two groups of *Ss* responded to both series	1. Shock was as frequent on outline series as on standard. 2. *P*, *A*, and *An* responses were more frequent (.01 level) on standard series;

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
			one month apart; counterbalanced order. Groups equated for age, education, sex. (Outline blots conformed to the basic form of standard blots but were devoid of shading and color.)	*FM* and *Bt* were more frequent at .05 level. *W* responses were less frequent on standard series (.05 level). No difference in *R, M, m, Ds, H, Hd, Ad, Ls.* 3. Texture responses were more frequent on card 4 of standard series but not on card 6; vista responses were more frequent on outline series (Cards 4 and 6).
Sterling (**90**)	To determine if color shock is due to color; to study other color effects.	20 neurotic males. Ages: 21–45.	Individual administration. *Ss* given 4 series, 2 days between each: achromatic, standard, series of colored parts taken from standard, and achromatic reproductions of the colored parts. All *Ss* took the 4 series in the above order.	1. Color has a major role in incitement of disturbance; it is a contributing element in the provocation of color shock. 2. Color effects the shock reaction by contributing to the reality of certain disturbing percepts; it is the congruity rather than the incongruity which is the basis of disturbance.
Allen, Manne, & Stiff (**2**)	To determine relationship between color and color shock signs.	25 college students.	Individual administration. Standard and achromatic series in counterbalanced order six weeks apart.	1. Frequency of color shock signs was as great on achromatic as on standard series; concludes that normal *Ss* do not show color shock signs.
Allen (**1**)	To determine if reaction time is affected by color.	Same as for Allen et al. above	Same as for Allen et al. above	1. Reaction times are not significantly different for standard and achromatic series.
Buker & Williams (**23**)	To determine effect of color on scoring categories other than direct color scores.	21 male schizophrenics. Ages: 20–40. $\bar{X}$ CVS IQ: 99. Education: 6–16 years.	Individual administration. Standard and achromatic series in counterbalanced order one month apart. (11 *Ss* took standard series first.)	1. Color increases reaction time to Cards 2, 3, 8, 9, 10; it *may* depress the *F*+% for 1, 4, 5, 6, 7 without affecting *F*+% for 2, 3, 8, 9, 10. 2. Color, as a discrete variable, does not materially influence responsiveness (26 scores tested).

(*Continued on next page*)

TABLE 1—(*continued*)

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Canter (**24**)	To study effect of color on performance.	76 psychology students (32 males). X̄ Age: 21.	Individual administration. Standard and achromatic series administered to two groups (N = 38) matched for age, sex, and "emotional constriction." No retesting.	1. R, $T/1R$, and $F+$ scores did not vary significantly as a function of color; no other dependent variables were tested.
Meyer (**64**)	To determine if color shock is due to color.	60 psychology students (30 males).	Individual administration. One group(N=30) given standard series; second group (matched for sex, age) given achromatic series. No retesting.	1. About 80% of both groups showed color shock; no sex differences. Color shock is not due to color.
Perlman (**68**)	To determine if 8–10/R% is affected by color.	36 university students (20 males). Median Age: in 20's. 34 NP patients (17 males). Median Age: 25. Median education: 12 years.	Individual administration. Standard and achromatic series in counterbalanced order one to eight weeks apart. Groups *not* matched.	1. Color does not affect 8–10/R%. 2. On retest the 8–10/R% tends to regress toward the mean.
York (**95**)	To determine color effects.	32 neurotics. Ages: 20–40. Education: above sixth grade. X̄ Verbal IQ (W-B): 112.	Individual administration. Standard and achromatic series to all *Ss* two weeks apart; counterbalanced order. Groups matched for age, education, IQ.	1. Color significantly impaired form perception ($F+$%). 2. Reaction times ($T/1R$) were faster and popular (P) responses fewer due to color when achromatic series was given first. 3. Variables other than color make the chromatic cards more difficult to interpret than the achromatic cards.

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Balloch (6)	To determine effect of degree of shading contrast on responses.	75 college students (54 males). X Age: 20.	Individual administration. First seven cards of Rorschach, Behn-Rorschach, and Harrower were photographed at three different contrast levels ($N=63$ blots). Each S in three matched groups was shown 21 cards, 7 at each contrast level. Latin square design. Circulatory and respiratory changes recorded in addition to verbal responses.	1. No changes in physiological responses. 2. Total number of times shading was used did not vary significantly with degree of contrast. 3. As contrast increased, the number of C' responses increased; the number of FK responses also varied significantly with contrast (highest frequency at medium contrast).
Allen, Manne, & Stiff (3)	To determine if color changes the consistency of responses on retest.	Same as for Allen et al. above.	Same as for Allen et al. above.	1. About 30% of responses on retest are identical to those given originally; color does not influence consistency of response.
Allen, Stiff, & Rosenzweig (4)	To determine if frequency of color shock signs for neurotics and psychotics is affected by color.	18 male NP patients (10 neurotics, 8 psychotics).	Same as for Allen et al. above.	1. Shock signs are as frequent on achromatic as on standard series.
Brody (17)	To determine color effects for both neurotics and normals.	100 males (50 neurotics). Ages: 18–35. Education: at least some college work. X W-B Vocabulary Score: 32.	Individual administration. 25 neurotics and 25 controls took standard Rorschach followed a week later by achromatic series. Matched groups (age, sex, education) took achromatic series first followed a week later by standard series.	1. Control Ss were not disturbed by the color, but neurotics were. Neurotics became disorganized and variable in their responses from one test or half of a test to the other. 2. In terms of a number of scoring categories, the presence or absence of color did not affect the responses of any of the groups.

(*Continued on next page*)

TABLE 1—(*continued*)

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Swartz (91)	To test the validity of the color shock hypothesis as a color phenomenon and to determine how hue affects the protocol.	50 neurotics and 30 normals (all males) Age: 20–47 Intelligence (Wonderlic): at least dull normal. Education: grade 6 through postcollege.	Individual administration. Each population divided into two subgroups. Standard and achromatic series presented in counterbalanced order with 2–4 month interval between tests. Subgroups equated for age, intelligence, and education.	1. Removal of color increases the number of form responses; no other clearly established color effects. The elimination of color did not affect the incidence of color shock.
Baughman (9)	To determine how perceptual behavior changes when color, shading, figure-ground, and form characteristics of the blots are altered.	100 male neurotics. $\bar{X}$ Age: 31. $\bar{X}$ W-B IQ: 114. $\bar{X}$ Education: 11 years.	Individual administration. Four modified series of blots (achromatic, silhouette, simple outline, complex outline) plus standard series. Each of 5 series administered to equated groups of 20 *Ss*. No retesting. *Ss* also rank ordered cards for preference.	1. The major dimensions of perceptual behavior remain constant even though marked alterations are made in stimulus attributes. 2. The basic form of the blot is of overwhelming importance in determining perceptual behavior, compared to stimulus attributes such as color and shading. 3. The importance of figure-ground contrast is also emphasized.
Belden & Baughman (12)	To determine relationship between figure-ground contrast and perception.	140 male psychology students.	Individual administration. Seven variations of Card 2: a line drawing corresponding to outline of blot plus 6 solid grays (no light variations within blot) with different contrast values. Seven matched groups (age, IQ, sex, education) responded to one card only.	1. Responses to line drawings differ markedly from those with a brightness contrast. 2. There is a level of figure-ground contrast at which perception becomes most efficient. More responses are given in shorter time, with greater accuracy, and with greater varitey in content when contrast is intermediate in value.

Author	Primary Purpose	Subjects	Method	Major Findings and Conclusions
Crumpton (**26**)	To determine if color is actually the stimulus for reactions commonly attributed to color.	60 male NP patients (20 psychotics, 20 neurotics, 20 organics). Ages: about 35. Education: about 11–12 years.	Individual administration. Standard series administered to 10 psychotics, 10 neurotics, 10 organics. Achromatic series administered to comparable group. No retesting. *Ss* also asked to choose most preferred and least preferred blot in addition to comparing chromatic and achromatic versions of same blot (for preference).	1. Color influences performance so that it can be detected by judges. 2. Color shock signs as frequent on achromatic series as on standard. 3. Color changes the distribution of content categories: More *Hd* and *Ge* on standard series, less *Aobj*. 4. More attention to form on achromatic series. 5. Judges find more aggressive and submissive concepts on chromatic blots; also more expression of unpleasant affect. Ratings of anxiety and pleasant affect are not influenced. 6. High hue-form incongruity *not* associated with lengthened reaction times. 7. *Ss* in general preferred chromatic cards to their achromatic counterparts, especially on Cards 8, 9, 10.
Grayson (**37**)	To determine effect of color and shading on productivity and card preference.	30 nurses in psychology course.	Group method. Standard series plus 9 experimental series: 3 achromatic (different degrees of blackness) and 6 monochromatic sets (blue, green, yellow, orange-tan, brick, red). Standard sequence of forms used, but each card was from a different one of the 10 series. Latin square design with triple replication. Preference ratings obtained for each card.	1. Interaction between form and color was significant in influencing productivity, but not color or shading alone. 2. Color and shading significantly influences the "pleasantness" rating given to a card.

While there has been considerable agreement that color should be the first stimulus attribute to be studied intensively as an independent variable by such methods, there has been wide variation in the selection of *S*s, research designs, and dependent variables. Color shock signs, reaction time, productivity, 8–10/*R*%, and preference values have received major attention as dependent variables, but in some investigations most of the commonly utilized summary scores have been analyzed as related to the color variable. Subject populations have included normals, neurotics, organics, and psychotics, but the college psychology student continues to show up as an *S* more often than members of any other single class. Research designs have used both individual and group administration techniques; they have also used counterbalanced orders of administration as well as single administrations of the test to equated groups of *S*s. When counterbalanced designs have been employed, the interval between readministrations has varied from two days to four months.

Before taking a closer look at the structure of the research designs summarized in Table 1, mention should be made of the modified stimulus materials used in these experiments since the experimental blots are not uniform from one study to another in the same sense as are the standard blots. Beginning with Wallen (**93**), achromatic reproductions of the standard colored blots were made by each investigator through his own photographic processes. Because of this fact one cannot be certain of the identity of the stimuli used in the various researches; actually it is most probable that the stimuli prepared in this way differ from one another in terms of such attributes as brightness, contrast, and clarity of internal form areas. An improvement in this regard was introduced by Allen (**1**) who had the achromatic versions of colored cards made by Verlag Hans Huber in Switzerland using the same presses, the same black ink as in printing the noncolor cards, and the same pressure as in printing the standard color cards. Others have recently begun to follow Allen's lead in this regard and have made use of the Huber achromatic modifications. Although this refinement in construction of experimental materials is highly desirable from a technical standpoint, the effects of the earlier lack of uniformity in materials is probably not very great. Balloch (**6**), for example, deliberately varied contrast levels but found that this did not significantly affect the number of times shading was used as a determinant.

A more important variation in the studies of color effects would seem to be that of *S* population, although evidence to be discussed later suggests that results are substantially the same despite marked differences in groups studied. Three groups of psychotics and one group of organics have been subjected to evaluation, but the total number of *S*s in these classifications has been small ($N = 69$). Most investigators have chosen instead to work either with normals or neurotics, as an examination of Table 1 will indicate. Allen (**1**) has argued strongly for the need of basal work with nonpsychiatric *S*s, to be followed by comparative analyses of various maladjusted groups. York, in contrast, has chosen to do his initial work with neurotics and states emphatically that "The validity of color shock, a set of reactions assumed by all Rorschach workers to be mainly characteristic of neurotics, cannot be adequately tested with a normal group" (**95**, p. 24). Primarily,

of course, the question here is one of research strategy since most investigators would probably agree that any complete understanding of color effects necessitates study of various groups. One advantage to be gained by working initially with neurotics, however, resides in the fact that theorists have consistently postulated more pronounced effects upon response due to color in this diagnostic group than in any other group. Failure to verify the reality of such effects, through tight experimental procedures, in a group where these effects are supposed to be maximized would lessen the urgency for similar testing of groups where the effects are supposed to be less pronounced.

The need to consider carefully the question of *S* population before interpreting the results of an experiment is illustrated by Lazarus' (**51**) report. One of his major conclusions is that color does not affect the frequency of color shock indices. His experiment, however, cannot be considered critical in this regard, for he worked with normals, who have been hypothesized to show fewer signs of shock than maladjusted groups. The results of this study contribute to the norms that Allen argues for, but they do not provide a firm basis for drawing conclusions about the relationship between color and color shock signs. Later studies with maladjusted *S*s, however, are in essential agreement with Lazarus' conclusion.

Only four studies (**37**, **51**, **72**, **78**) have made use of group testing procedures as part of the experimental design, and of these, three represent work carried out in 1949 or earlier. Subsequent research has utilized the individual method of administration almost exclusively. There are several reasons for this preference, among the most obvious of which is the fact that one is unable to measure the latency of responses in the group situation. Inasmuch as latency of response has always figured heavily in the formulation of color and shading shock, studies which purport to examine color and/or shading effects but which do not provide time scores thereby weaken the effectiveness of their arguments. Another obvious disadvantage of the group procedure is the fact that it does not usually provide inquiry data for scoring of responses in as adequate detail as does the individual method. If such scores are to be used as dependent variables (and they have been in most studies), clearly their measurement should be as precise and reliable as technique permits. Added to these obvious disadvantages is the fact that most Rorschach workers have been reluctant to accept the group procedure as equivalent to the individual method. To use the group procedure faces the researcher with an inevitable question: "But would an individual technique give comparable results?" For these reasons it appears wise that most investigations have been built around individual technique, even though comparison of group and individual studies reveals no essential contradictions between the conclusions to be drawn from them.

The question of what type of research design is preferable for analyzing color and shading effects has elicited divided opinion. Ten studies have utilized a test-retest design in which *S*s have responded to both the standard blots and an achromatic series, half of the *S*s receiving the standard series first and the remaining half receiving the achromatic series first. As already noted, the length of time between successive administrations has varied from a few days to four months. The remaining studies have avoided retesting the same *S*s; most of them have tried in-

stead to use matched groups of *Ss* who responded to series of blots which differed in some specified way. Two studies have made use of a latin square design.

Perhaps the most cogent criticisms of the test-retest design for problems of this sort have been advanced by Canter (**24**). In his analysis Canter raises five objections, two of which penetrate most deeply and are interrelated. The first questions the validity of assuming (as one must in using such a design) that the influence of presenting A before B is equivalent to the influence of B before A. The second points up the error introduced by memory factors which affect the *S*'s set and his responses on repeated administrations of the Rorschach; such factors are well nigh impossible to evaluate.

Without pursuing this matter in detail, an example of a possible difficulty in evaluating behavior elicited in a test-retest design may assist in clarifying the general point. Subject A responds to the achromatic series; ten days later he looks at the standard series and when he comes to Card II he evidences a startle reaction. Is this due to the sudden introduction of color, or is it because he suddenly realizes that he is not going to be looking at the same series of blots after all? Subject B gives a similar startle reaction to Card II when he initially responds to the standard series; on repeat administration with the achromatic series he again appears ruffled on Card II. Does this mean that color had nothing to do with his initial reaction? Or might color have been instrumental initially with "change" being the effective stimulus in the repeat administration? It is clear in such designs that variables other than the intended independent variable are being introduced, and that a design which is useful for much psychological research has limited utility for the question at hand. This would indicate an advantage for the matched group approach, if the groups are carefully equated on pertinent variables. Again, however, there appears to be essential agreement in the results obtained by utilization of these two designs.

In order to examine more closely this question of the degree of agreement in results among the studies in which color[4] has been treated as an independent variable, Table 2 has been prepared. This table contains most of the dependent measures which have been reported by several different investigators. To construct the table, it has been necessary to take a few liberties in translating some scoring symbols into Beck's (**10**) system. By examining each column the reader may determine the extent of agreement on the question of whether or not the presence or absence of color affects a particular scoring category. For example, 13 investigators all agree that color does not significantly affect the number of responses (*R*) given by *Ss*; the remaining investigators do not present data on this variable.

Inasmuch as most researchers analyze several dependent variables, occasional significant relationships are likely to be found which can in fact be attributed to chance considerations. Because of this, a positive finding should be confirmed by other research before it is given much weight. Holding this in mind, and examining Table 2, it is clear that color has little effect upon *Ss*' behav-

[4] Two studies (Balloch [**6**], Belden & Baughman [**12**]) listed in Table 1 treat only blot attributes other than color; one study (Barnett [**8**]) alters color, shading, and figure-ground properties in a manner so that it is not possible to consider resultant variations in behavior as being related to a single blot dimension.

TABLE 2

RELATIONSHIPS BETWEEN COLOR AND VARIOUS RORSCHACH MEASURES

Senior Author	Preference	Content	Shock Signs	*T*/*1R*	*R*	8–10%	*P*	*S*	*W*	*D*	*Dd*	F+% or *F*+	*M*	*m*	*FM*	*Y*	*V*	*F* or *F*%	*H*	*Hd*	*Aw*	*A*%
Lazarus (**50, 51**)		O	O		O	O	X	X	O	O	O	O	O	O	O	O	O	X	O	O	O	O
Wallen (**93**)	X																					
Reece (**72**)	O	O	O		O		O	O	X	X	O		O	O	O	O	O	X				
Sappenfield (**78**)					O	O																
Dubrovner (**28**)				O	O	O																
Siipola (**84**)	X	X		X															X	O	O	
Siipola (**85**)		X		O[a]																		
Sterling[b] (**90**)			X																			
Allen (**2**)		O	O		O	O	O		O	O		O										
Allen (**1**)				O																		
Buker (**23**)		O		X	O	O	O	O	O	O	O	O	O		O	O	O		O	O	O	O
Canter (**24**)				O	O							O										
Meyer (**64**)			O	O		O	O					O	O								O	O
Perlman (**68**)						O																
York (**95**)		O	O	O[c]	O	O	O[c]					X									O	O
Allen (**3**)		O																				
Allen (**4**)		O	O	O	O	O	O		O	O		O	O									
Brody[d] (**17**)		O		O	O	O			O	O	O		O	O	O	O	O	O	O	O		
Swartz (**91**)		O	O	O	O	O	O		O	O	O	O	O	O	O	O	O	X			O	O
Baughman (**9**)	X	X		O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	O	O
Crumpton (**26**)	X	X	O	O	O	O	O					O				O		X		X	O	O
Grayson (**37**)	X				O																	

X Indicates author reports significant relationship between color and this score.
O Indicates author finds no significant relationship between color and this score. No entry indicates author did not report for this score.
[a] Authors attribute this to their experimental design and the memory factor; do not believe that Siipola's original findings are unsupported.
[b] Sterling reports the frequency of various shock signs related to measures in this table, but not individual tests of their significance.
[c] York reports significant relationships between color and these measures when *S* is administered achromatic series before standard.
[d] Brody presents several hundred *t* tests and correlation coefficients which are difficult to summarize in this table. The author does not believe that any consistent relationships between color and the above dependent variables are demonstrated, but the reader is best advised to refer to the original source before accepting this interpretation.

ior, at least to the extent that behavior is accurately reflected in these scores. Total productivity, productivity on the last three cards, color shock signs, popular responses, figure-ground reversals, location scores, form accuracy, projection of movement, shading responses, and the most common content categories are little affected by the presence or absence of color.[5]

The weight of the evidence also suggests that latency of response ($T/1R$) is not significantly affected by color, although two reports are in disagreement with this conclusion. Siipola's (**84**) work is cited most frequently in this regard. The problem situation confronting her *Ss*, however, differed from that facing *Ss* in the usual Rorschach test, and it is quite possible that this difference accounts for the discrepancy in results. Siipola's *Ss* were given single blot areas which they had to interpret even though the object suggested by the form might have a color incongruent with the color of the blot area. *Ss* with high need for form-color congruity might easily block in such a situation with resultant increase in response time; in the usual Rorschach test situation, however, *Ss* are not forced to respond to such incongruous areas but may select other areas which pose no such problems of congruity. Siipola has thus created a type of set and demand for her *Ss* which is not comparable to that faced by *Ss* in the Rorschach situation. Crumpton's (**26**) findings, based upon the full Rorschach, tend to confirm this interpretation of Siipola's results.

The other significant relationship between color and latency was reported by Buker and Williams (**23**) in their study of schizophrenic *Ss*. Altogether they analyzed 26 dependent variables, reporting no other material influence on responsiveness attributable to color. It may be then that this one significant finding would not hold up on replication. The consistency of findings from other studies showing no significant relationship between color and latency suggests this as a probability.

At this point it is clear that the evidence is overhwelming in its refutation of the idea that color has broad, pervasive general effects upon *Ss*' Rorschach behavior, as asserted by numerous theorists. In the final analysis, however, it may be the positive findings contained in Table 2 which prove to be the most significant. First of all, it is apparent that color does make a difference to *Ss* in their feeling or aesthetic response (listed as preference in Table 2) to the blots. Wallen (**93**) was the first one to demonstrate this, and subsequent research has confirmed his early finding even though a variety of procedures have been used to get at an *S*'s preference for particular blots.[6] Second, it is suggested that color may influence the conceptual content elicited even though frequency of response in the major content categories is unaffected. The lack of agreement re-

[5] Since the scores C, CF, and FC cannot be applied to responses on the achromatic series, significant decrements in these categories when compared with the standard series are inevitable; hence these scores are not listed in Table 2. In a similar way, one would anticipate an increase in F% (responses based on form only) when other attributes (such as color) are not available for the *S* to use. Four studies have shown significant increases in the number of form-determined responses on the achromatic series; other studies show a tendency in this direction even though the difference is not sufficiently large to reach statistical significance.

[6] The exception is Reece's (**72**) study. The reason for this one discrepancy is not clear, although it may be due to the fact that Reece used slides in a group situation and a relatively insensitive method for getting at preference behavior.

garding this second point (which is evident in Table 2) arises in part from the fact that the studies have differed widely in their analyses of content data; some have treated it rather superficially whereas others have carried out rather minute analyses. It is, perhaps, misleading to include conceptual content as a separate category since there has been so little uniformity in its treatment. The thing to be remembered, however, is that content differences traceable to color can be demonstrated if one looks closely enough and if a sufficient number of *S*s are examined.

It is difficult, however, in this context to fully appreciate the significance of the positive findings regarding color as related to preference and content, engulfed as they are by numerous negative results, pertaining to other variables. Perhaps the most that can be hoped for is that they suggest to the reader that color does somehow make a difference to most *S*s in the way they perceive and respond to ink blots. In a later paper, considerable attention shall be devoted to a new method of inquiry which will make clear the fact that much of the difficulty encountered in demonstrating both color and shading effects is methodological in nature. By developing an entirely new inquiry procedure, it is possible to show color and shading effects which are to a great extent obscured in the studies under consideration. In this instance, as in many other scientific endeavors, a major bottleneck proves to be methodological in nature.

The results summarized in Table 2, however, make it clear that one cannot begin with variations in summary scores and use these as bases for inferring color effects. The same conclusion will probably prove to hold true for shading, although sufficient research on shading has yet to be completed. An individual's summary scores can be traced predominantly to the interaction of his personality characteristics with the form properties of the blots; color and shading effects are more subtle and do not affect behavior in a gross enough way to appreciably modify such scores. Another way of putting this is to state that summary scores are not sufficiently sensitive to reflect color and shading effects.

It is also true that on the basis of available data one cannot take particular content categories of responses and draw inferences about the effects of certain stimulus variables. For example, the response "fire" or "blood" suggests immediately that the *S* is responding to color, but when an examiner receives these responses to achromatic cards he realizes that he is faced with a more complex problem. Several authors point out examples of such responses (**9**, **24**, **72**) in the color area. Barnett (**8**) raises a similar problem for shading when he reports vista responses given in response to outline blots in which no shading variations exist. In fact he reports a higher frequency of these responses for Cards IV and VI of the outline series than for the standard series. Baughman (**9**) also obtained vista responses to outline figures, but the frequency was not as great as for *S*s responding to the regular or achromatic series.

In summary, the following major points may be made with respect to studies attempting to clarify the role of the stimulus by manipulation of blot properties:

1. Almost all of the work has focused upon the effect of color; shading, figure-ground contrast, and other stimulus dimensions have been neglected.

2. Despite marked variations in research design and *S*s studied, the re-

sults of the investigations are in substantial agreement.

3. Summary scores and color shock signs do not vary significantly as a function of color.

4. Color does affect *S*s, however, most noticeably in their "preference for" or "liking of" particular blots; but also to some extent in the content elicited by the blot.

5. The Rorschach, as currently used, elicits little in the way of behavior that can be taken as a basis for inferring color effects. The same statement is probably valid also for shading.

6. Rorschach behavior, as reflected in summary scores, is a product primarily of the *S* and the form properties of the blots.

Studies Dealing with Physiological Correlates

Rather than taking summary scores as dependent variables, a number of researchers have turned instead to investigations of physiological activity occurring during administration of the blots. Since color, shading, and other dimensions of the test situation are supposed to stimulate affective responses, these workers have reasoned that analysis of physiological activity (especially autonomic activity) should further our understanding of the Rorschach test. Skin conductance (the psychogalvanic response) has been studied most frequently (**32**, **36**, **41**, **52**, **65**, **73**, **74**, **87**, **89**) but investigations making use of blood pressure (**41**), heart rate (**41**, **87**), respiration (**41**), and the eye blink (**87**) have also been reported.

The research methodology used in these studies has been quite uniform; in most instances the investigator has simply made continuous records of the physiological activity in which he was interested while his *S*s were responding to the standard Rorschach blots. Research populations have included pathological groups (**32**, **36**, **73**), as well as normals (**32**, **36**, **41**, **44**, **52**, **73**, **87**, **89**), and both individual (**32**, **36**, **41**, **44**, **52**, **87**, **89**) and group administrations (**73**, **74**) have been utilized. It has been customary also to divide *S*s into those showing color shock and those not showing shock (**73**, **74**, **87**, **89**) as determined by usual Rorschach criteria. The question has then been asked as to whether such groups differ in their physiological response to the blots.

A frequent finding in these studies is an adaptation effect, by which is meant that autonomic activity tends to be elevated at the beginning of the test series but levels off as the *S* presumably adjusts to the situation and becomes less anxious. The validity of this interpretation, however, is not firmly established since only Levy (**52**) and Steinberg (**89**) report work in which the order of presenting the cards was varied. The possibility therefore remains that there are specific card effects related to those ordinarily coming early in the sequence which are independent of card position. The findings of Levy and Steinberg, however, argue against the likelihood of this possibility.

The experimental designs utilized in the physiological studies make it impossible to draw any definite conclusions about the relationships between autonomic activity and specific blot attributes. Although several authors contrast autonomic response to the colored blots of the standard series with similar responses to the noncolored blots of the standard series, it is evident that these two groups of blots differ from one another in terms of form, figure-ground contrast, symbolic associations, and other properties in addition to color differences. Even if one were to find significant differences in autonomic

activity through such comparisons, one would not know what the critical dimensions were of the stimuli which were creating such differences. The most that can be learned through such designs is whether there are significant card differences in the provocation of autonomic activity; even this cannot be determined, however, unless order effects are also investigated.

Rockwell et al. (**74**) report the only study available in which experimental manipulation of blot properties has been combined with autonomic measurements in order to get at the effect of a blot dimension (color) more directly. Twenty-three *S*s were administered color slides of the standard Rorschach while a record was made of their palmar skin resistance; a repeat testing with achromatic cards was then carried out. The data were described as showing color-shock *S*s differing from noncolor *S*s in that the former did *not* evidence differential effects in skin resistance between the two situations whereas the latter group did. This finding is only suggestive, however, because of both the small number of *S*s and the failure to use a counterbalanced order of presentation. Nevertheless the study is valuable in the sense of suggesting how measures of autonomic activity might be used as dependent variables along with experimental alteration of the stimulus material in order to clarify the effect of specific stimulus attributes; investigators need not be limited in their work to an analysis of verbal behavior.

Several workers in this area have been concerned primarily with the question of whether different groups of *S*s differ in their autonomic response to the Rorschach blots (**32, 36, 73**); correlates with blot properties have been of secondary interest to them. This appears to be one of the reasons why the experimental designs have such marked limitations in terms of the question that is central to our interest here. Keeping this in mind, the following tentative conclusions can be drawn from the studies under consideration:

a. There are marked inter-*S* differences in autonomic response to the Rorschach blots.

b. Individual cards have different affective values for different *S*s, but cards cannot be termed emotional or nonemotional since they are not consistent in their effects upon all or even a majority of *S*s.

c. Physiological activity while an *S* is giving a color response does not appear to be significantly different from that occurring while he is giving a noncolor response.

d. The position of a card in the series is significant, there appearing to be adaptation effects.

Perhaps the most pertinent summary, however, with respect to the status of investigations utilizing this approach is to be found in the words of Siple as he reports on his study: "The treatment of data used in the present investigation does not permit a clear differentiation between effects of color and effects of other factors" (**87**, p. 39). Perhaps additional investigations making use of the method employed by Rockwell et al. (**74**) will assist in clarifying some of these questions regarding stimulus influences at a nonverbal level.

Symbolic Meanings of Rorschach Figures

From almost the beginning of Rorschach work individuals have concerned themselves with the symbolic properties of the blots. Male or female blots, father or mother cards are only a few of the concepts that have been advanced in this regard. Persons interested in the role of the stim-

ulus in this sense seem to have been preoccupied primarily with the question of the total impact of the blot on the *S* rather than with any attempt to analyze the blot so as to determine the relative influence of the various stimulus dimensions. To perhaps oversimplify, it has been a question of defining whether Card VII is more feminine than Card IV rather than attempting to define empirically the basis for this difference, if it is in fact found to exist.

Three studies illustrate the point just made. Meer and Singer (**62**) asked 50 college males to select both a mother and father card. Cards IV and II were chosen most often as father cards, Cards VII and X most often as mother cards. It is not clear, however, what it was about the cards that led to these differences. In a similar fashion, Shaw (**83**) requested 50 college males to locate sexual areas on the cards. Only Card VI produced more male than female responses, there being about twice as many female as male responses for all 10 cards. Again the bases in the stimuli are not identified; in fact, Shaw points out that one cannot even be certain whether the predominantly female gender of the percepts is a function of the structure of the blots or is due to the male composition of the group. Pascal et al. (**67**) help clarify this latter question when they report that both male and female *S*s give more female than male responses. Also, like Shaw, they found Cards I, III, II, and VI to be the most sexually suggestive in the series. From studies of this type it is possible to conclude that there are intercard differences in sexual properties and that femaleness predominates over maleness, i.e., there is what might be termed a sex bias in the stimuli. The studies do not, however, give a basis for understanding the emergence of these responses as a function of particular stimulus properties or combinations thereof.

Rosen extended the empirical investigation of symbolic meanings by asking 193 psychiatry students (118 males) to choose that card which suggested each of the following feelings or associations: (*a*) male sex organ, (*b*) masculine aggression, (*c*) authority, (*d*) father symbol, (*e*) mother symbol, and (*f*) family symbol. He also considered the states of emotional security and insecurity. Among the findings was that Card IV was associated with the father symbol (confirming Meer and Singer), with masculine aggression, and with authority. Card VII was related to the mother symbol (again confirming Meer and Singer). Card VI was associated with the male sex organ and Card X was seen as the family card; also as suggesting emotional insecurity. Cards II and VII, in contrast, provoked associations of emotional security. Despite these significant findings, however, Rosen emphasizes that no card approaches identity in meaning for all *S*s. He concludes that "The Rorschach would thus appear to consist of stimuli which have a partial, but not a total, symbolic communality for *S*s" (**75**, p. 244).

In another study, Guertin and Trembath (**38**) attempted to determine the significance of Card VI as a stimulator of behavior related to psychosexual disturbance, with generally negative results. Most discussions (e.g., **29**, **43**, **53**, **54**, **55**, **56**, **69**, **81**) of content and symbol interpretation have remained, however, at primarily a theoretical level with insufficient empirical data. In fact, the few empirical studies referred to do little more than confirm what the experienced user of the Rorschach already knew. Carefully controlled work on symbols has been confronted with

methodological obstacles since the beginning of interest in this problem, and resolution of these difficulties appears to remain a formidable challenge.

Other Studies Related to Stimulus Properties

Comparison of Rorschach with Parallel Series

Responses to the Behn and Harrower series of inkblots have been compared to those elicited by the Rorschach blots in several studies (**22**, **31**, **60**, **76**, **86**). The major interest has been in the equivalence of the various series of blots. It is only indirectly that such research touches upon the stimulus problem, although the research itself is based upon the recognition that the stimulus factors are critical. Although Buckle and Holt (**22**) address themselves to the differences between each pair of inkblots, most researchers have been interested instead in the question of whether the various series give identical or near-identical summary scores. Two studies (**76**, **86**), for example, suggest that the Behn tends to elicit more color responses than the Rorschach. Since each blot in research of this type differs simultaneously from its counterpart in terms of not only color but form, shading, and other stimulus attributes, it is not possible to proceed very far toward identifying the relevant stimulus dimensions. One can say that two blots do or do not differ in terms of the behavior they stimulate, but not the basis for the result. This fact is pointed up by Buckle and Holt when they indicate that " . . . We have no systematic theory of how responses can be influenced by changes in the ink blots" (**22**, pp. 486–487).

Intercard Comparisons

Differentials in response to the 10 Rorschach blots have always been recognized, in the formal as well as the content sense. Reaction time to Card V is fast, productivity is low, and the bat is a frequently perceived form, compared to the characteristics of responses to Card X. Ranzoni et al. (**71**) were among the first to present extensive empirical data of this type in order to define what they called "card-pull" for each of the cards. Other studies (**11**, **33**, **34**, **39**, **58**, **61**, **63**, **66**) also provide data which may be used for analyses of this type.

As long as the responses alone to each card provide the total data for study, such research is faced with the same limitations as those pointed out for comparisons made with parallel series. That is, one can describe how two or more cards compare in productivity, reaction time, and similar variables but the reasons for difference are often obscured. For practical work it is, of course, extremely important to understand card tendencies of this sort since it is against them that the individual response of a particular *S* must be compared, but the basic theoretical questions remain unanswered.

Some of the empirical studies referred to above, however, do attempt to go beyond this descriptive level (**34**, **39**, **66**). They do so by asking the *S* to indicate card preferences and then to give his reasons for his choices. Through this and related procedures, the following tentative conclusions are suggested:

(*a*) For some groups, preference for a card is inversely related to its sexual suggestiveness (**33**).

(*b*) More intelligent *S*s tend to prefer more complex cards (**34**).

(*c*) Color tends to be a more important factor than content in determining preference for a card by normal *S*s (**39**).

(*d*) Normals give color as the ma-

jor reason for liking a card best, neurotics give ease or difficulty of the card, and psychotics give specific content as the primary factor (**66**).

The differential significance of various blot attributes for different *S* groups is suggested by these studies, but their results must be considered keeping in mind the limitations of introspective analysis.

Card Order Effects

Stimulus effects are complicated by the fact that the *S*, after responding to Card I, no longer responds to subsequent blots independently of his experience with previous blots. These order effects have not been studied extensively, despite an early report on the problem by Rabin and Sanderson (**70**). Placement of a card in a series influences certain components of response, although the precise extent and nature of the influence is not known. Maradie (**57**), however, has demonstrated through use of a Latin-square design that later appearing cards produce more responses than earlier appearing cards. Effects of order upon other aspects of response appear to be in need of similar clarification.

Miscellaneous

An early study utilizing a rather ingenious methodology is the often quoted study by Brosin and Fromm (**18**) making use of color defective *S*s. Several possibilities were advanced to explain why neurotic color-blind *S*s showed color shock, but the authors neglected to consider that what was termed color shock behavior might not be due to the color dimension of the stimuli. Subsequent research (see second section of this paper) indicates this to be the likely factor. A subsequent theoretical paper by the same authors (**19**) gave explicit recognition to the need for clarifying the role of the stimulus, and proceeded to analyze the Rorschach figures in terms of 11 basic principles coming from Gestalt psychology. In similar fashion, Klein and Arnheim (**47**) argued that the perceptual characteristics of the blots as visual stimuli should be explored in their own right. They then proceeded to an intensive analysis of Card I in terms of Gestalt principles. Earlier, Arnheim (**5**) had distinguished between two types of human movement responses, one based upon a kinesthetic experience and the other upon visual properties of the stimulus. Following Arnheim's lead, Eckhardt (**30**) carried through an empirical study in which he was able to demonstrate that certain shape gradients (e.g., an ellipse) evoked more movement responses than did regular shapes (e.g., a circle).

Using a quite different technique (but one which might be used to advantage by those interested in the Gestalt characteristics of the blots), Blake (**14**) photographed eye movements of *S*s as they looked at the blots. The initial fixations tended to be embedded inside the blot with later ones moving towards the periphery. Blake interprets his data as supporting the hypothesis that specific features of each card determine the fixations after the initial centering tendency has been completed. He then lists those areas of each card which seem to have the greatest demand value as judged by ocular behavior. The stability of these findings on achromatic versions of the standard chromatic cards would prove an interesting approach to color effects at a nonverbal level.

Stein undertook an exhaustive study of the perceiver's role in perception utilizing tachistoscopic exposure of the cards. Of interest here, however, is his suggestion that color and shading may reverse their order

of importance as determinants depending upon exposure time. "At very brief exposures, the hierarchy of determinants based on the sensory aspects of the blots is form first, shading second, and color third . . . . The hierarchy which emerges at the longer exposures changes to form first, color second, and shading third" (**88**, p. 409). The writer has unpublished data, however, which are not consistent with Stein's findings; further research is needed to clarify this inconsistency.

Numerous studies have attempted to examine the question of whether an *S*'s response to a particular stimulus quality (e.g., color, white space) is related in a consistent way to extra-Rorschach behavior. Ultimately, of course, this is a very important question, but it is somewhat tangential to the primary purpose of this paper. The reader is referred to reports by Bandura (**7**), Sarason and Potter (**80**), Matarazzo et al. (**59**), Ruesch and Finesinger (**77**), and Holzberg and Schleifer (**40**) for illustrative examples of such research.

Conclusions

It is apparent, from the studies reviewed, that the definition of Rorschach stimulus effects is more a task for the future than an accomplishment of the past. In fact, empirical concern with this question appears to have been something of an afterthought with users of the technique. Variation in the stimulus, in order to define an independent variable, has been such a standard procedure in psychological research that it is surprising to find it being applied only during very recent years to an analysis of the Rorschach. Other methods, as indicated, have contributed to the clarification of this problem, but they have not, as yet, gone very deeply.

Studies addressed to "card-pull" substantiate what every experienced clinician knows, namely that the individual blots vary widely in the classes of responses they evoke. Productivity, latency, content, and other response variables are not ordinarily independent of the stimulus to which the *S* is responding. Such studies are valuable, of course, even to the experienced tester, for they assist him in correcting for his own sampling biases. For the beginner, they are even more important. At the same time it must be recognized that this approach does not go much beyond the descriptive definition of differences.

The 25 experiments attempting to go beyond this descriptive level by introducing variations into the stimulus conditions tempt one to conclude that the form or shape of the blot is the only relevant dimension. Certainly color does not appear to affect behavior very much, and if color is ineffective shading seems even less likely to be a significant variable. Other blot properties (such as figure-ground structure) have at best evoked the interest of an occasional researcher.

Perhaps this is the point to indicate a most important limitation in these studies. They do not really provide a basis for concluding that color, shading, and other blot dimensions do not affect an *S*'s behavior, or the way he experiences and reacts to the blots. Actually, the only conclusion that appears to be justified by empirical research is that color has little or no effect upon an *S*'s behavior *to the extent that his behavior is represented by psychogram or similar scoring scales.* One may anticipate that a similar conclusion will prove to be justified for shading, but the necessary research is not yet in. About other dimensions, only guesses are possible.

Concern with behavior, in the overt sense, has led many to forget

that one of the primary assets of techniques like the Rorschach is the providing of a basis for knowing about another person's subjective experience. Two individuals may be passive in their behavior, but one may experience the world as continuously threatening while the other does not. Similarly, two individuals may respond to the Rorschach with such identity as to receive equivalent psychogram scores, but can one be certain that there has been a similar equivalence in the way that they have experienced the blots? Does the absence of shading scores, for example, mean that two persons have been equally unresponsive to the shading properties?

Statements about another person's experience are always inferential, never directly observable. The starting point is observation, and the task for the person who desires to know another person's experience is to create a situation which will evoke behavior that can be used to draw the inference. In the Rorschach this means that the examiner is limited primarily to the verbal statements made by the *S* during the free association and inquiry. Recognition of this fact immediately focuses attention upon the question of whether the inquiry, as usually conducted, gives an adequate basis for drawing inferences about how the *S* has experienced color, shading, and other blot properties during the association period. Until alternate methods of inquiry are developed and compared, the question must remain unanswered. To anticipate, however, work completed by the author and planned for publication will show significant effects traceable to method of inquiry, effects which markedly alter the inferences drawn.

The research reviewed makes it clear that color does not have the pervasive effects upon overt behavior that have been so often claimed. These studies should not, however, lead to an equally erroneous conclusion in the opposite direction. Simple requests for preferences have made it clear that *S*s do experience the blots differentially related to various blot dimensions, even though their overt behavior as reflected in summary scores may give no basis for drawing such an inference. To correctly evaluate the role of the stimulus, new methods must be devised for drawing samples of behavior that will permit proper inferences to be made.

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STUDIES OF THE CONDITIONING OF VERBAL BEHAVIOR[1]

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There have recently been appearing in the literature an increasing number of reports on a new approach to experimentally determining the parameters of interpersonal situations. These studies have generally appeared under a "verbal conditioning" label and within the framework of applying learning theory to verbal behavior.

Skinner points out that:

> the term "verbal behavior" has much to recommend it. Its etymological sanction is not too powerful, but it emphasizes the individual speaker and, whether recognized by the user or not, specifies behavior shaped and maintained by mediated consequences. It also has the advantage of being relatively unfamiliar in traditional modes of explanation.
>
> A definition of verbal behavior as behavior reinforced through the mediation of other persons needs, as we shall see, certain refinements. Moreover, it does not say much about the behavior of the listener, even though there would be little verbal behavior to consider if someone had not already acquired special responses to the patterns of energy generated by the speaker (**94**, p. 2).
>
> The effect of this procedure in releasing a response from a specific controlling condition is usually achieved in another way. Instead of using a great variety of reinforcements, each of which is relevant to a given state of deprivation or aversive stimulation, a contingency is arranged between a verbal response and a *generalized conditioned reinforcer*. Any event which characteristically precedes many different reinforcers can be used as a reinforcer to bring behavior under the control of all appropriate conditions of deprivation and aversive stimulation. A response which is characteristically followed by such a generalized conditioned reinforcer has dynamic properties similar to those which it would have acquired if it had been severally followed by all the specific reinforcers at issue.
>
> A common generalized conditioned reinforcer is "approval." It is often difficult to specify its physical dimensions. It may be little more than a nod or a smile on the part of someone who characteristically supplies a variety of reinforcements. Sometimes . . . it has a verbal form: *Right!* or *Good!* Because these "signs of approval" frequently precede specific reinforcements appropriate to many states of deprivation, the behavior they reinforce is likely to be in strength much of the time (**94**, pp. 53–54).

The studies to be reviewed in this paper follow this Skinnerian paradigm in that the dependent variables are the *S*'s verbal behavior and the independent variables are generalized conditioned reinforcers intended to bring verbal behavior under the control of the examiner.

Thirty-one studies (**4**, **7**, **15**, **16**, **17**, **21**, **27**, **39**, **40**, **41**, **44**, **46**, **51**, **54**, **56**, **61**, **62**, **64**, **66**, **68**, **85**, **86**, **88**, **89**, **91**, **95**, **96**, **97**, **101**, **105**, **107**) have certain features in common that distinguish them as a body of research which belongs together. They are all studies of operant conditioning of verbal behavior. These should be differentiated from another group of studies to which have been applied the label of "verbal conditioning" (**9**, **18**, **26**, **33**, **38**, **49**, **50**, **67**). Generally these latter studies consist of the conditioning of "verbal expectations" using the Humphrey's procedural paradigm (**49**). The response conditioned was usually pressing one of two available keys to predict the occurrence of a random event. Following the *S*'s prediction, and independently of it, the examiner presents one of the to-be-predicted events according to a predetermined random sequence (**18**, **26**, **67**). A variation of this occurs in

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those studies in which the occurrence of the reinforcement event is contingent upon the appropriateness of the *S*'s response (**18, 25, 67**). These studies have been used to test predictions from statistical learning theories (**26**).

The studies to be reviewed can also be differentiated from those of verbal learning under various reward and punishment conditions (**2, 10, 11, 12, 14, 73, 80**), and the studies of learning a verbal task under various motivational sets, and attitudinal influences (**1, 22, 23, 47, 71, 74, 98, 104**). In the verbal behavior studies to be reviewed, the specific task given to the *S* is *not* presented as a learning one. The *S* is *not* asked to "learn" a given series of words, nonsense syllables, or paired associates, nor is he even told that "learning" is involved in the studies. Rather the *S* is asked to emit verbal behavior in terms of a given task, and the examiner attempts to reinforce a preselected class of his "verbal behavior" by carefully controlled verbal or nonverbal behavioral cues.

Survey of the Studies

The studies of conditioning "verbal behavior" will be reviewed in terms of the following categories: setting, verbal response, reinforcing stimuli, population, controls, length of experimental sessions, relationships to personality variables, results, and "awareness."

Setting

To what extent can one generalize to interpersonal situations other than one labeled specifically "research"? With but four exceptions (**46, 85, 86, 101**) each of the studies described here was clearly labeled as a "research" study in which the *S*s, were voluntary, more or less. The *S*s were aware that whatever they were participating in was of some psychological nature. Whether one can label "volunteer" an undergraduate introductory psychology student who has to spend a portion of time as an *S* is a moot point, but at least he knew that he was in for something of a research nature even if he didn't know just what. In one of the studies which was an exception to this general rule, Verplanck's (**101**) 17 examiners performed their cueing in ordinary conversations with friends, without the other person's being informed that he was participating in a psychological experiment. The *S*s were cued in student living quarters, in restaurants, in private homes, and in a hospital ward, a public lounge, and over the telephone.

Response

In these studies, the class of verbal behavior reinforced varied from very specific types of verbalization to broader units of expressions of feeling or attitudes. There are four general categories of experimental situations: saying words or numbers; completing sentences; "story telling" and interviews; and participating in a test-like situation.

Saying words or numbers. Greenspoon (**39, 40**), Mandler and Kaplan (**61**), and Sidowski (**91**) attempted to reinforce plural nouns. The *S*s were told to "say all the words that you can think of. Say them individually. Do not use any sentences or phrases. Do not count. Please continue until I say stop." Wilson and Verplanck (**107**) alternated reinforcing of plural nouns and adverbs in a similar "say words" situation. Tatz (**97**) instructed his *S*s to say an "unsystematically varied three digit number" each time a light goes on.

Completing sentences. By far the

largest group of studies used a variation of technique first reported by Taffel (**96**). He used as stimulus three by five, white, unlined index cards. In the center of each card was a different verb in the simple past tense. Below the verb were the pronouns I, we, you, he, she, they. There were 90 different orders of the six pronouns. These were randomly assigned to each card. No card had the same order of pronouns. Instructions were for the *S* to use each card to: "make up a sentence using this word. Below the word in the center, you will see a group of other words. Take any one of these and use it to start your sentence. Answer with the first sentence that comes to your mind." The class of behavior reinforced was sentences beginning with either I or we. This technique was also used by Cohen (**15**), Daily (**17**), Grossberg (**41**), Hartman (**44**), Klein (**54**), and Marion (**62**).

In a variation of this technique, I. G. Sarason (**89**) reinforced a class of verbs rather than a type of pronouns in a sentence. Sarason presented three by five cards with the word "he" on top and on the bottom three typed verbs of equal frequency of occurrence in the English language. One of the three verbs was a verb of the reinforced class; the other two verbs were neutral words not of the reinforced class. Verbs of the class "verbal activity" were chosen as the reinforced class of behavior. This category included verbs having to do with the vocal apparatus, i.e., "talked," "whispered." B. Sarason (**88**) also conditioned verbs in a similar manner.

Binder, McConnell and Sjoholm (**7**) used two sets of verbs, one "mildly hostile" and the other "neutral." Randomly matched pairs of these verbs were typed on white cards with three pronouns, "she," "he," and "they" in capital letters. The *Ss* were instructed to make up sentences with one of the pronouns as the first word and one of the verbs as the second word in the sentence.

Story telling and interviews. In this group of studies an arbitrarily selected category in a story telling situation or interview was reinforced. Ball (**4**) instructed his *Ss* to tell imaginative stories to include the three categories of "man," "woman," and "animal." The category "animal" was reinforced. Krasner (**56**) instructed *Ss* to "tell a story with at least four characters in it, a mother, a father, a child, and an animal." The category "mother," all nouns and pronouns referring to the mother figure, was selected to be reinforced. A similar technique was used by Mock (**66**).

Salzinger and Pisoni (**85**, **86**), in the context of an interview situation, asked "would you tell me why you are here in this hospital?" A series of interview questions followed. The verbalization reinforced was each affect response, which was defined as "Any statement describing or evaluating the state (other than intellectual or physiological) of the patient by himself." Only those affect statements were included in the response class in which the patient referred the affect to himself by using the pronouns "I" or "we," i.e., "I am satisfied," "I'm happy," "We enjoyed it," "I like him."

Verplanck (**101**) reports on the conditioning of statements of opinion beginning with "I think," "I believe," "it seems to me," "I feel" and the like in ordinary conversations when the *Ss* were not aware that it was part of an experimental situation.

McNair (**64**) reinforced rate of verbalization in *Ss* asked to talk about three successive pictures pre-

sented by means of a slide. These were pictures of interpersonal situations.

Test-like situations. In the fourth category are specific responses made by the *Ss* participating in a test-like situation. Fahmy (**27**) reinforced human responses on an ink-blot test. Wickes (**105**) reinforced movement responses on specially devised ink blots. Kanfer (**51**) and Spivak and Papajohn (**95**) used as the critical response an estimate of distance moved in an autokinetic stimulus situation. This response was selected on the basis of having been a response of low frequency on the trial period.

Hildum and Brown (**46**) reinforced "attitudes" toward a previous selected topic "general education" in an interview situation. They used a questionnaire of 15 items with four possible responses to each, ranging from "strongly agree" to "strongly disagree." The statements were so worded that agreement with some statements represented an unfavorable attitude. Consequently, the interviewer reinforced an "attitude" rather than a specific response category.

Ekman (**21**) administered a questionnaire on capital punishment. It consisted of 63 items tapping the various issues involved in the use of capital punishment. Five alternative answers were provided for each item ranging from "strongly agree" to "strongly disagree." Anti-capital punishment replies were selected as the response to be reinforced.

Cushing (**16**) presented a series of 80 pictures to his *Ss* and had them rate the pictures as to how much they thought they would like or dislike the person. In his two experimental groups he reinforced either the "like" or "dislike" responses.

Nuthmann (**68**) conditioned "acceptance of self" responses on a true-false personality test. The items were presented on index cards, and the *Ss* were asked to read them aloud and then to decide as to whether these items were true or false for themselves. The actual response reinforced was the pressing of a true or false switch in front of the *S*. Thus, technically, this was not a study of conditioning of verbal behavior as such but rather the translation of the verbalized behavior into a motor response, switch pressing.

Reinforcing Stimuli

The reinforcing stimuli can be divided into three general types of cues: verbal, gestural, and mechanical devices.

Verbal cues. The most widely used examiner verbal behavior is the emission of the "mmm-hmm" sound. Even the possibility of differences in examiner interpretation of how the "mmm-hmm" should be emitted was controlled in the Hildum and Brown (**46**) study. The examiner was a trained linguist who carefully equated the intonation used in reading questions and responding. He verbalized the "mmm-hmm" in a neutrally toned, rising inflection. As a further control the "mmm-hmming" was done over a telephone. Greenspoon (**40**) goes so far as to give the phonetic construction of the "mmm-hmm" (and "huh-uh") based on Pike's American English Intonation. He does admit, however, that the stress and phonetic pattern are not pronounced in exactly the same way each time. Other studies to use "mmm-hmm" as a reinforcer include Ball (**4**), Daily (**17**), B. Sarason (**88**), and I. Sarason (**89**).

Other verbal cues used in these studies include "good" (**15, 16, 17, 41, 44, 46, 54, 62, 68, 96**), "uhha" (**85,**

86), "yeah" (85, 86), "I see" (85, 86), "that's accurate" (51), "that's right on the button" (51), "that's a good one" (27), "give another, please" (27), "you're right" (101), "right" (95), "all right" (105), "fine" (105), "I agree" (101), paraphrase of *S*'s response (101), and repetition of response (27, 101).

Nonverbal gestural cues. The gestural cues included head nodding (44), head shaking (44), and smiling (101). Mock (66) used a combination of head nodding and "mmm-hmm" with one experimental group, and a combined head shake and "huh-uh" with another group. Krasner (56) used a smile in addition to the head nod and "mmm-hmm." Wilson and Verplanck (107) alternated the cues of "mmm-hmm," "good," and writing down the key word. Wickes (105) alternated a head nod, smile, and leaning forward of the body with one of his two experimental groups. In two of his four groups Ekman (21) used a combined nonverbal reinforcement consisting of a head nod, a smile, and a slight movement forward.

Mechanical cues. The mechanical cues used were a light flash (4, 39, 68, 91, 96), a buzzer (4, 39), and a bell tone (64).

Populations

With but a few exceptions, the subject populations consisted of either the undergraduate introductory psychology student (4, 7, 16, 17, 27, 39, 40, 41, 51, 61, 62, 64, 68, 95, 97, 105, 107), or the hospitalized schizophrenic patient (44, 54, 56, 66, 85, 86, 89).

The major exceptions were: Verplanck (101) used men and women whose relationships to the student examiners were as friend, roommate, uncle, "total stranger," and "a date." Both B. Sarason (88) and Cohen (15) used a general medical hospitalized Veterans Administration population. Hartman (44) was the only study to compare diverse groups of *S*s. He worked with a group of schizophrenic patients and a group of psychiatric aides.

Examiners

Is one examiner more effective than another in his usage of these various cues, or is the "mmm-hmm" itself effective irrespective of the "mmm-hmm-er?" Generally, these studies have used only one individual examiner. However, there were eight studies which were exceptions to this: Verplanck (101) used 17 students of a course in "The Psychology of Learning"; Wilson and Verplanck (107) also used 15 student examiners; Salzinger and Pisoni (85, 86) repeated their interview situations with an examiner of the opposite sex. Wickes (105) used two examiners.

Binder, McConnell and Sjoholm (7) studied the effect of experimenter differences upon performance in a verbal conditioning situation. They used two *E*s differing markedly in physical and social characteristics. Their examiners were an "attractive, soft-spoken, reserved, young lady who was 5′½″ in height and 90 pounds in weight," and a male who was "very masculine, 6′5″ tall, 220 pounds in weight, and had many of the unrestrained personality characteristics which might be expected of a former Marine captain." In appearance, as well as in fact, there was a difference in age, the male being older by 12 years. Their hypothesis was that conditioning rate is a function of experimenter characteristics even though the situation was one in which the participation of the *E* consisted

only of making a single word, "good" response and the *Ss* were unaware of the reinforcing contingency.

Controls

All of the studies used one or both of two types of controls: either a control group selected from the same population, which did not receive any reinforcement; or the experimental group had as its control a prereinforcement set of trials, or a set period of time. Thus the prereinforced rate of response, or operant level, could be established as a basis of comparison. Some of the studies also examined extinction phenomena by repeating the experimental situation without reinforcement.

Length of Experimental Sessions

Most of the studies have been conducted over short intervals, or have been determined by the length of time needed to complete a certain number of responses or sentences.

Greenspoon's (**39**, **40**) *Ss* spent a total of 50 minutes. Mandler and Kaplan's (**61**) *Ss* gave 500 noun responses. Wilson and Verplanck's (**107**) *Ss* verbalized 800 words. The sentence completion studies used between 80 and 260 trials (**15**, **17**, **41**, **46**, **54**, **62**, **96**). McNair's (**64**) *Ss* spent about 10 minutes in the test situation. Tatz (**97**) required 160 three-digit responses from his *Ss*. Hildum and Brown (**46**) used a 15-item questionnaire; Ekman (**21**) used a 63-item questionnaire. Nuthmann's (**68**) *Ss* answered 140 true-false questions. Kanfer's (**51**) *Ss* spent 45 minutes in the autokinetic situation. Fahmy's (**27**) *Ss* responded to 40 ink blots; Wickes (**105**) used 30 ink blots. Salzinger and Pisoni (**85**, **86**) had their *Ss* undergo two interviews which lasted 30 minutes each. Ball (**4**) had his *Ss* tell their stories for five 10-minute sessions spaced at two-day intervals, a total of 50 minutes. Krasner's (**56**) *Ss* told their stories for 25 10-minute sessions totaling four hours. Mock (**66**) used 20 ten-minute sessions, totaling about three and one-half hours. Verplanck's (**101**) student conversations were carried on for 30 minutes.

Relationship of Conditionability to Personality Variables

Most of the studies were not oriented to correlating the conditioning phenomena with any personality characteristics. However, there were some notable exceptions to this.

Both Taffel's (**96**) and Daily's (**17**) *Ss* took the Taylor Anxiety Scale previous to the conditioning runs. Cushing (**16**) hypothesized a relationship between conditionability and a measure of the need for social approval. I. Sarason's (**89**) study dealt with the interrelationships between three variables: The *S*'s score on a personality inventory (an autobiographical survey—a true-false test devised by Sarason which yielded scores in such personality variables as anxiety, need for achievement, defensiveness, and hostility); the therapist's ratings of the *S*'s behavior in the psychotherapy situation and the *S*'s performance in the verbal conditioning situation. Sarason made several predictions as to the outcome of this study. The first was that *Ss* with high scores on the anxiety scales would condition faster than *Ss* with low scores on these scales. This prediction was based on the hypothesis that in a novel situation such as verbal conditioning in which the *S* has no prior knowledge of what constitutes a correct response, anxious individuals will be relatively more likely than nonanxious ones to increase the frequency of reinforced responses be-

cause they would be actively seeking cues in an ambiguous situation. Individuals with high defensive and hostility scores should condition slower than others based on the hypothesis that individuals who are defensive and/or hostile will frequently be unlikely to accept interpretations, reinforcements and cues from others.

Sarason's *Ss* were rated by their therapists on three characteristics which seemed to be related to certain characteristics of their personality test performance. These items concerned the degree of compliance with which the patient accepts therapist's interpretations, the degree of dependence the patient evinces towards the therapist and the degree of hostility the patient displays towards the therapist. It was expected that the hostile *S* would condition more slowly than the compliant and dependent *Ss*. High compliance and dependence therapist ratings were expected to be related to faster verbal conditioning on the basis of the need of the patient to please authority figures.

B. Sarason (**88**) investigated the problem of whether the alteration in verbal behavior persists when the reinforcements cease and the stimulus situation is modified. In an interesting design, she used a free word naming interval before and after conditioning. In her conditioning series, the response conditioned was sentences with "bodily activity" verbs. She compared the number of "bodily activity" verbs in the before and after word naming sessions.

Ekman (**21**) hypothesized a relationship between conditionability and drive state. Drive state was defined in terms of stress inducing instructions, "One of the interesting things we have found in this poll is that those people with the most healthy creative personalities all hold a particular opinion regarding capital punishment."

McNair (**64**), Kanfer (**51**), Spivak and Papajohn (**95**), and Grossberg (**41**) were all interested in the effects of differing schedules of reinforcement on the acquisition and extinction of the conditioned verbal responses.

Results

Greenspoon (**39**, **40**) found that using "mmm-hmm" as a reinforcer resulted in an increase in the frequency of plural responses, and "huh-uh" resulted in a decrease of the frequency of plural responses. When used to reinforce nonplural responses, both stimuli tended to increase the frequency of such responses. The stimulus "mmm-hmm" had the same effect on both plural and nonplural responses, but the stimulus "huh-uh" had different effects on the two type responses. The red light and the tone both resulted in significant increases in the mean frequency of both response classes. Thus Greenspoon got a conditioning effect with his two verbal and his two nonverbal stimuli.

Every *S* in Verplanck's (**101**) study increased in rate of verbalizing statements of opinion when the examiner reinforced by either paraphrasing or agreeing with his statement. Twenty-one out of 24 *Ss* decreased in rate under nonreinforcement conditions. Verplanck (**100**) reports that he tried to repeat the Greenspoon (**40**) experiment in a class at Harvard. The *Es* had had very little previous work with human conditioning. They were "game," however, and cornered their *Ss* in a variety of places. A few *Es* obtained unequivocally positive results, but not always without the *S*'s becoming aware of the reinforcements. The successful *Es* were the most prestige-

ful, socially adept individuals, and the unsuccessful ones were of what might be called "lower prestige." At the same time, attempts were made to condition simple motor behavior, using reinforcers such as "mmm-hmm," smiles, and "good." The results, as with verbal behavior, were "indifferent." In a further replication, Wilson and Verplanck (**107**) repeated the same study with *E*s who had acquired considerable experience in the conditioning of human motor behavior. These experienced examiners had "no difficulty" in reproducing the changes in rate of verbalizing words of a particular class. The examiner alternated their three reinforcing stimuli, "mmm-hmm," "good," and writing the word down in reinforcing plural nouns, adverbs, travel words, or words of living things. They got significant results in 27 out of 30 *S*s, and extinction under conditions of no reinforcement.

Mandler and Kaplan (**61**) found little effect of the reinforcer "mmm-hmm" on the relative production of plural nouns when the data on all their *S*s were combined. However, the authors interviewed their *S*s and found that there were two distinctly different interpretations of the stimulus "mmm-hmm." The "positive" group consisted of those *S*s who thought that the reinforcer had positive aspects; it meant that they were doing all right, it was encouraging them to go on. The negative group thought that the reinforcer had negative aspects; it meant they were going too fast, giving the wrong kinds of words. When the results of the positive and negative *S*s were separated, there was a clear difference in conditionability between the two groups. The "positive" group showed a significant increase in plural noun production during the first period of reinforcement while the "negative" group showed a decrease in this period. In the subsequent periods, no such difference between these two groups appeared.

Taffel (**96**) obtained significant results with "good" as a reinforcer. However, in contrast to Greenspoon (**39**), he did not obtain significant results with a light as reinforcer. The patients with high and medium anxiety scores on the Taylor Anxiety Scale significantly increased their reinforced verbal behavior under conditioning, while patients with low anxiety scores did not. Taffel offers an interesting explanation for the failure of the light to act as a reinforcer in both his experiment and that of Ball (**4**), whereas it was effective with Greenspoon. Taffel contends that in the situation devised by Greenspoon, the verbal responses made by the *S* were not meaningful in the sense that no attempt to communicate with the examiner was involved, whereas this was not so in Taffel's and Ball's experiment. He hypothesized that it is possible for a stimulus to function as a reinforcer in a verbal situation which involves an attempt at communication. The stimulus itself must contain associations or connotations that can be related to the success or failure of this attempted communication. In the Taffel study, the light was considered by the *S* to be either part of a timing set-up or an attempt at distraction. It was not associated with the particular response made by the *S*.

The results of Cohen et al. (**15**) indicated successive increments in the reinforced response for the group under reinforcement condition but no change for the control group. In the extinction part of the study, there was a marked decrease in the "I," "we" responses, originally reinforced

when reinforcement was shifted to "he" and "they" responses. No extinction of the "I," "we" responses appeared in the groups in which reinforcement was completely discontinued. A further result of interest was the lack of any significant differences in effectiveness among the four experimenters used in this study.

In Marion's study (**62**), which was oriented towards determining the differential effects of examiner status, the reinforced and nonreinforced groups did not differ significantly with respect to mean scores. Marion concluded that:

> 1. Within our experimental procedure male college counselees do not increase their relative use of the criterion response class (I or we pronouns) unless their experimenters have relatively high status. 2. With respect to the differential influence of reinforcement as employed in this experiment experimenters differ for reasons other than status. 3. One of the factors involved in the variation among experimenters in the differential influence of reinforcement may be the clinical experience of the experimenter.

Daily (**17**) found that, although there was an increase in the frequency of the correct responses for the verbally reinforced groups during acquisition, there were similar increments in the control group which was not reinforced. The differences in scores between the "good" reinforcement group, the "mmm-hmm" reinforcement group, and the control groups were not statistically significant. Daily attributes the difference in results between his study and those of Taffel (**96**) and Cohen et al. (**15**) to variations in procedure, population, and examiner status. No significant differences in the frequency of the reinforced response was found between anxious and nonanxious *S*s.

In Klein's (**54**) study the frequency of reinforced responses ("I," "we") increased significantly during conditioning in all of his conditioning groups. Following conditioning of these responses, they were extinguished in all three of his extinction groups. He compared three methods of extinction: negative reinforcement ("no good"), counter-conditioning (of alternative responses), and nonconditioning. He found that the fastest extinction occurred under negative reinforcement and slowest extinction under "nonconditioning."

I. Sarason (**89**) found that high scores on the test anxiety and "lack of protection" scales were found to be significantly associated with higher levels of verbal conditioning. On the other hand, high defensiveness scores were found to be related to relatively poor verbal conditioning. Patients rated by their psychotherapists as being compliant were found to perform in the verbal conditioning situation at a significantly higher level than patients rated as being relatively noncompliant.

Binder, McConnell, and Sjoholm (**7**) found that the response "good" was reinforcing for the class of behavior consisting of the use of hostile words in sentences. The rates of learning for the *S*s of the two *E*s differed significantly with the steeper slope for the female *E*'s group. They felt that it would have been reasonable to expect that the response would have a greater reinforcing effect when uttered by a big, prestigeful male experimenter, than by the slightly built, soft-spoken female. However, they speculated that the female provided a less threatening environment in which the *S*s were less inhibited in their usage of hostile words. They found "good" an effective reinforcer with hostile words in contrast to a preliminary study by Buss and Durkee which they quote. Buss and Durkee did not find "good"

effective in conditioning "intensely hostile" verbs whereas, "right" and "wrong" were effective. The differences in results, as between the two studies, is attributed to differences in examiners. The results of the Binder et al. study may be of significance in interpreting the differences in conditionability reported in various studies.

Ball (**4**) in his story-telling situation obtained significant conditioning results. The positive reinforcer "mmm-hmm" resulted in significant conditioning at the 1% level of confidence. Treated as a group, the negative verbal stimulus "huh-uh" was not an effective reinforcement. "However, analysis of the operation of the negative situation for individual cases indicates that it tends to have two different, possibly opposite effects—some *Ss* showing a decrease in frequency but some showing a marked increase contrary to the socially accepted meaning of the verbal stimulus" (**4**). The two nonverbal stimuli (light and tone) tended, but not to the point of significance, to reinforce the verbal behavior under study, with the *Ss* in these groups showing considerable variation.

Salzinger and Pisoni (**85, 86**), reinforcing affective responses, found that the greatest number of such affect statements were emitted during the conditioning sessions, the next greatest number during operant level, and the least during extinction, with all three conditions significantly different. The relationship between number of reinforcements and number of affect responses in extinction was linear, i.e., the greater the number of reinforcements, the greater the number of extinction responses. Also, this relationship held up irrespective of placement of reinforcement.

Krasner (**56**) organized his data into successive blocks of five sessions each, alternating nonreinforcement and reinforcement conditions. The reinforced class of verbal behavior, "mother" responses, increased under reinforcement, decreased under nonreinforcement, increased again during the succeeding reinforcing series, and decreased again during the final block of nonreinforcement. Mock (**66**) also used a design of alternating blocks of reinforced and nonreinforced sessions. He found significant increases in the reinforced class of behavior, also "mother" responses, in the first block of reinforcement sessions, but not in the succeeding reinforcement series. This increase occurred in the "positive" group in which the head nod was combined with the verbalization "mmm-hmm." A similar result was obtained in his "negative" group, a significant decrease in the reinforced behavior under "negative" reinforcement, head shake plus "huh-uh," during the first, but not the succeeding series of sessions. The behavior of the *Ss* in the second reinforcing sessions was characterized as being "inconsistent."

Fahmy (**27**) found that the use of "good one" as a reinforcer resulted in significantly more human responses on her ink-blot test when she compared her experimental group with a control group. Other cues such as "give another one, please," and repeating the response did not result in significant differences. In the Wickes (**105**) study, both the verbal cues ("good," "fine," "all right"), as well as the nonverbal cues (smile, nod, lean forward), were effective in increasing significantly the verbalization of movement responses on an ink-blot test. There were no differences in effectiveness between the two examiners used.

The results of the Hildum and Brown (46) study indicated that verbalizing "good" reinforced positive "attitudes" while verbalizing "mmm-hmm" did not. They replicated the study on a second group of *Ss* with different examiners and obtained the same results. In the Nuthman (68) study the verbal stimulus "good" resulted in a significant increase in "acceptance of self" responses, but she did not achieve "conditioning" with a light flash as stimulus.

In all four of Ekman's (21) experimental groups, anti-capital punishment opinion responses were conditioned. He found no differences between the effectiveness of verbal ("good") and nonverbal (head nod, smile, and slight movement forward) reinforcement, nor differences between the stress and nonstress conditions for conditioning in general. Ekman reported that the most significant results in his study were the large number of *Ss* who counterconditioned. The groups receiving nonverbal reinforcement showed greater counterconditioning than the groups receiving verbal reinforcement. Reports of counterconditioning with various reinforcing stimuli and various responses appear in Hildum and Brown (46), Mandler and Kaplan (61), Nuthmann (68), Verplanck (101), and Hartman (44). Ekman speculates that counterconditioning may be related to a personality variable such as negativism or rigidity.

Cushing (16) found that the use of "good" as a reinforcing stimuli of responses indicating "like" to a person's picture gave significant results, whereas "good" did not result in significant results with the response of "dislike." Nor did he find a significant correlation between a measure of the "need for social approval" and conditionability.

In Kanfer's (51) study the results indicated that acquisition under a partial reinforcement procedure required more trials but fewer reinforcements than acquisition with a continuous reinforcement procedure. Extinction with a continuous reinforcement procedure showed greater initial resistance but faster decline than extinction under a partial reinforcement procedure. The Spivak and Papajohn (95) group receiving regular reinforcement was quickly extinguished under nonreinforced trials while in the group given a variable interval reinforcement no one extinguished in the given experimental period. McNair (64) also found that differential rates of reinforcements had distinct effects upon rates of responding. Grossberg (41), on the other hand, did not find differences in effectiveness of acquisition, nor in resistance to extinction, between continuous and partial reinforcement groups.

Hartman's (44) results have important implications for this type of study. He found that the initial level of response preference contributed markedly to his results. There was no difference in conditionability between the two groups he used: schizophrenic patients and psychiatric aides. "Good" and a head shake were effective reinforcers, whereas a head nod was not. The introduction of the initial levels variables showed marked differences between the two populations with the schizophrenics showing more persistence of originally preferred response tendencies. In his conclusions he emphasized the importance of using the original response as a control variable.

The results of the Tatz (97) and Sidowski (91) studies will be discussed in the next section because of the relevance of "awareness" to their results.

A summary of the results of the studies reviewed here is presented in tabular form in Table 1.

"*Awareness.*" The existence of "awareness" on the part of the *Ss* about the purposes of the experiment may well be the aspect of these studies which raises the most interesting questions. The *Ss* change their verbal behavior as a function of responding to stimuli controlled by others. How aware are the *Ss* of what is taking place? This brings us to a time-honored and traditional psychological problem: can learning take place without the *S*'s awareness that he is learning? Adams (**1**) in a review of the literature, points out that the experimental evidence in all types of studies is far from conclusive as to the existence of such learning. Although Adams does a thorough and comprehensive analysis of all relevant studies, brief mention will be made of this aspect as related to the studies under review here because of the increasing importance "awareness" has in understanding the process of the conditioning of verbal behavior.

The primary means of attempting to measure "awareness" of *Ss* is some form of an open-ended questionnaire. Greenspoon (**39**, **40**) asked each *S* four questions: "What do you think it was all about," "Did you notice any change in the kinds of words you were saying," "What do you think the purpose of the "mmm-hmm" was," "How long do you think you were saying words." In treating his data Greenspoon eliminated those *Ss* who were able to verbalize the relationship between the contingent stimulus and the response which followed. He thus eliminated 10 of his 75 *Ss*. This technique of open-ended questions intended to ascertain "awareness," and the elimination from the results of the few aware *Ss*, is generally followed in the other studies, with some variations. Over half of the studies reported that none of the *Ss* evidenced awareness. In all, roughly 5% of all patients in the 31 studies combined became "aware" by the definition of each *E*.

Wilson and Verplanck (**107**) report that despite the fact that the majority of their *Ss* "noticed" the reinforcing stimuli, most were unable to relate that stimuli to a response class of their own behavior. Nor was there a difference in the behavior of those *Ss* who became aware of the variables and those who did not.

The hypothesis of the Tatz (**97**) study was that some *Ss* in these verbal conditioning studies achieve partial solutions without verbalizing the exactly correct verbalizations and that this will result in a significant increase in their "conditionability" score. He asked his *Ss* to verbalize three-digit numbers and reinforced ("good") any response which included either of two predetermined "correct" digits. Two of his groups were called "no information" groups because the *Ss* were given no information about the existence of a "correct" response. In contrast, the two "informed" groups were told that some numbers were correct and those would be followed by "good." In two of the four groups the click of an electric counter served as a control for the verbal reinforcer "good." To determine the *S*'s awareness, and especially their interpretation of the reinforcement, a questionnaire of about 30 open-ended items was administered. It began with a general "What did you think about during the experiment?" and led to specific detailed questions. The results of the study were that the two "informed" groups showed a high rate of conditionability. The group with no information and a verbal reinforcer also conditioned but not to

TABLE 1

SUMMARY OF RESULTS OF "VERBAL CONDITIONING" STUDIES

Author	Reinforcing Stimuli	Class of Behavior Reinforced
	Positive Results[a]	
Ball	"mmm-hmm"	"animal"
Greenspoon	"mmm-hmm"	plural nouns
Mandler & Kaplan	"mmm-hmm"	plural nouns
B. Sarason	"mmm-hmm"	verbs
I. Sarason	"mmm-hmm"	"verbal activity" verbs
Mock	"mmm-hmm," head nod	"mother"
Krasner	"mmm-hmm," head nod, smile	"mother"
Salzinger & Pisoni	"mmm-hmm," "uh-ha," or "I see"	affect statements
Wilson & Verplanck	"mmm-hmm," "good," or writing	plural nouns, adverbs or travel verbs
Binder et al.	"good"	"hostile" verbs
Cohen et al.	"good"	"I," "we" pronouns
Cushing	"good"	"like" person in pictures
Grossberg	"good"	"I," "we" pronouns
Ekman	"good"	anti-capital punishment response
Hartman	"good"	"I," "we" pronouns
Hildum & Brown	"good"	"attitudes"
Klein	"good"	"I," "we" pronouns
Nuthmann	"good"	"acceptance of self"
Taffel	"good"	"I," "we" pronouns
Tatz	"good"	a pair of digits
Fahmy	"good-one"	human responses
Spivak & Papajohn	"right"	autokinetic effect
Wickes	"fine," "good" or "all right"	movement responses
Wickes	head nod, smile, or lean forward	movement responses
Ekman	head nod, smile, and lean forward	movement responses
Greenspoon	light	plural nouns
Sidowski	light	plural nouns
Greenspoon	buzzer	plural nouns
McNair	bell tone	rate of verbalization
Verplanck	paraphrase, agreement, smile	opinions
Kanfer	"that's accurate," etc.	autokinetic effect
Hartman	head shake[b]	"I," "we" pronouns
Mock	head shake, "huh-uh"[b]	"mother"
Greenspoon	"huh-uh"[b]	plural nouns
	Negative Results[c]	
Daily	"mmm-hmm"	"I," "we" pronouns
Hildum and Brown	"mmm-hmm"	"attitudes"
Cushing	"good"	"dislike" persons in pictures
Daily	"good"	"I," "we" pronouns
Marion	"good"	"I," "we" pronouns
Hartman	head nod	"I," "we" pronouns
Fahmy	repetition of response	human responses
Fahmy	"give another one, please"	human responses
Ball	light	"animal"
Nuthmann	light	"acceptance of self"
Taffel	light	"I," "we" pronouns
Ball	buzzer	"animal"

[a] The reinforced behavior changed significantly in the hypothesized direction during reinforcement sessions.
[b] Resulted in decrease; all others resulted in increase of reinforced behavior.
[c] The reinforced behavior either did not increase significantly or its increase was no more than in a control group.

the level of the "informed" groups. The group with no information and no verbal reinforcement showed a significant decrease in "correct" responses. Based on his questionnaire results, Tatz divided his *S*s into four types of "aware" classes ranging from a completely correct verbalization of the reinforcing conditions of the experiment to no awareness of any implications of anything unusual going on. Tatz concludes that his study casts doubt on the selection of *S*s in most other studies on the basis of their being "unaware." He demonstrates that the *S*s may evolve "partial" solutions, even when they are not told that there is anything to solve. Further, these partial solutions, which may not be verbalized on the completion of the study, may mediate a level of responding higher than that to be expected by chance.

Sidowski (**91**) also attempted to determine the differences in conditionability between "aware" and "nonaware" *S*s. Awareness consisted of being told that there was a specific task to solve, but no description of what the task was. He found no difference in conditionability between those that were aware there was something to be aware of and those that were not aware that they should be aware of something.

Mandler and Kaplan (**61**) gave each of their *S*s the Tatz questionnaire (**97**) to determine their reactions to the reinforcing situation. The responses of all *S*s were scored on a scale of 1 to 11, with a score of 1 representing full awareness of the reinforcing contingency and 11 representing a complete lack of awareness. Full awareness was defined as a description by the *S* of the contingency between the plural noun response and the *E*'s behavior, while complete unawareness required that the *S* verbalize no hypotheses concerning this contingency. The obtained awareness values ranged from 3 to 11 with a mean of 5.9. This rating indicated that the average *S* verbalized some secondary hypotheses that there might have been some unknown relationship between his associations and the *E*'s behavior. None of the *S*s, however, was able to state specifically what the contingency was.

Taffel (**96**) asked each *S* the following questions: "Did you usually give the first sentence that entered your mind?"; "How did you go about deciding which of the words on the bottom to use?"; "Which do you think you used the most times?"; "Why?" None of the individuals in any of the groups were able to verbalize the purpose of the study. The predominant sentiment was a reflection of the original instructions that this was a psychological test. Klein (**54**) reported that the correct contingency between the *S*'s response and the *E*'s behavior was verbalized by only one *S* out of the total of 100. Daily (**17**) also gave a brief questionnaire. If the *S* mentioned during this inquiry that he noted the relationship between his "I" or "we" sentences and the *E*'s verbalization, he was not included in the analysis and he was replaced by another *S*. Eight *S*s were so discarded.

Marion (**62**) used the same questions as did Taffel (**96**) and Klein (**54**) plus five additional ones: "Did you notice anything I did during the experiment?"; "Why do you think I did that?"; "Did it have any effect on what you did?"; "What was the effect?"; "What was the purpose of the experiment in your opinion?" Only two *S*s were aware of the reinforcement and they were eliminated and replaced by another two. Very few *S*s were able to recall what pro-

noun they had used frequently. This result and the variety of guesses made regarding the purpose of the experiment indicates that none was aware of the contingency between his verbal responses during the experimental session and those of the *E*.

Cohen et al. (**15**) report that questioning of *S*s revealed no awareness of the contingency between their responses and those of the examiner. I. Sarason (**89**) reports the same lack of awareness. Ball (**4**) reports that no *S* in the positive reinforcement group but all *S*s in the negative group and one-half of the *S*s in the buzzer and light groups were aware of the relationship between the *E*'s behavior and their own. None, however, were able to interpret the study as one of learning.

Krasner (**56**) also used a brief questionnaire and found no evidence of awareness. Salzinger and Pisoni (**85**, **86**) make no mention of awareness, but the context of the interview situation was such that awareness seemed precluded. Mock (**66**) found a close relationship between degree of awareness of reinforcement and inconsistency of behavior. He hypothesized that the increased variability of his experimental groups during their second block of reinforcing sessions, and the failure to obtain an over-all "conditioning" effect, can be attributed to an increasing "awareness" on the *S*'s part of what was taking place.

Nuthmann (**68**) reported that in response to the question, "Did you think that anything I said had anything to do with your responses," five *S*s in her "good" group and four in her "light" group could verbalize the purpose of the experiment. She concludes that those who were not able to verbalize the correct purpose were actually unaware because for the most part they verbalized contradictory hypotheses about the purpose. There was no difference in conditioning results between those *S*s who were aware and those who were not.

Hildum and Brown (**46**) found that eight of their 20 *S*s noticed that the interviewer said "good" but only one of these assumed that it meant approval. Only one in 20 *S*s noticed that the examiner said "mmm-hmm." This *S* thought that it might have meant approval. All *S*s rejected the notion that their answers had been influenced by the interviewer's reaction. In the Ekman (**21**) study the majority of the *S*s in the groups reinforced by verbal cues were able to correctly identify the reinforcement contingency while only half of the groups reinforced by nonverbal cues could do so.

Verplanck (**101**) reports that in no case was the *S* aware that he was the *S* of an experiment or that the conversation was an unusual one. Verplanck adds in a footnote that after having described the experiment to someone in casual conversation, he had the illuminating experience of then being used as an *S* by the person to whom he had described it. He showed the effect and, like all other *S*s in the experiment, was quite unaware that he had been an *S*.

In McNair's (**64**) experiment, only two *S*s evidenced any suspicion of deception and even these were unable to relate any connection between their rate of verbalization and the bell-tone stimulus. Neither Kanfer (**51**) nor Spivak and Papajohn (**95**) go into the question of awareness.

Discussion

There are many broad implications that can be drawn from a survey of these studies of conditioning of verbal behavior. Before discussing them

further, these studies should be placed in perspective insofar as they may be related to other areas of psychological research which also have bearing upon understanding interpersonal processes. Extentions of the principles of the conditioning of verbal operants can be seen in at least five different areas of current investigation. References will be to typical studies in the area rather than exhaustive listings.

Psychotherapy may be seen as one unique type of interpersonal relationship in which great stress is put upon the importance of verbal behavior. Research studies of the process of psychotherapy are increasing but still remain in the scarce category (**30, 31, 42, 43, 45, 52, 65, 82, 106**). Further comments about the implications for psychotherapy will be made below.

There have also been an increasing number of studies designed to explore the use of nonverbal communication in interpersonal situations, to determine the effectiveness of nonverbal as against verbal cues, to systematically vary examiner behavior, and to devise methods of identifying and quantifying behavior involved in interpersonal interactions both in group and in individual situations (**3, 8, 13, 20, 63, 72, 75, 76, 79, 83, 84, 90**). The principles of operant conditioning are being increasingly utilized in experimental studies with children (**5, 6, 24, 28, 29, 34, 35, 36, 57, 77, 92, 103**). The Estes (**24**) study of reinforcing verbal behavior in children actually preceded the studies of reinforcing adult verbalizations which are under review here. There is also an increasing number of experiments in which operant conditioning techniques are extended to motor behavior of adult humans (**32, 48, 53, 58, 59, 69, 70, 99, 102**). In some of these studies there is report of the use of the conditioning of verbal and/or motor behavior as a specific therapy or as part of an over-all plan of therapeutic approach (**53, 58, 59, 69, 70, 99**). Finally, there are a number of studies of specific examiner influences in testing situations (**37, 60, 87**).

One line of approach to the verbal behavior studies reviewed here is to see them as the outgrowths of the combination of Skinnerian methodology with the Rogerian approach to psychotherapy. Most of the studies were undertaken within a Skinnerian frame of reference (**93, 94**) with special emphasis on the importance of verbal behavior and the principles of operant conditioning. Roger's (**81, 82**) contribution has been the nondirectivist emphasis on the use of minimal cues such as "mmm-hmm" by interviewers and therapists and the emphasis on research into the process of psychotherapy.

In a previous paper, the writer (**55**) has pointed out that:

> The therapist learns what behavior on his own part is most effective with particular types of patients and behaves accordingly. Put in terms which would permit a behavioral analysis, the problem is to isolate the dimensions of the therapeutic situation and determine what the lawful relationships are between the therapist's behavior as the independent variable and the patient's behavior as the dependent variable. . . . It becomes a question of the probability of the patient's emitting a certain class of behavior in the light of the type of reinforcement this behavior has received previously in the therapeutic situation and prior to that, in life situations.

However, with few exceptions, all of these studies have been in artificial, laboratory settings. Would the reinforcers or cues be effective in a situation labeled "psychotherapy," in which the *S* felt that there was a therapeutic relationship involved? It

would be reasonable to assume that in such a situation the subject-patient would be all the more alert to look for cues for guidance as to what the examiner wants, just as the patient does in a therapy situation. The more ambiguous a situation, the greater the need to seek cues as to what to do. In all the studies reviewed here, the *S* was given a specific task: make up a sentence, tell stories, answer specific questions, describe a picture. He had little obvious need to seek cues as to what to do.

If future results in this area confirm the indicated trends, it might be concluded that all psychotherapy is to some extent directive in nature. The therapist uses cues, often without his own awareness, to modify, control, guide, or manipulate the patient's verbal behavior. This mode of subtle communication can probably be offered as a means of understanding how the therapist's own theoretical explanation of the dynamics of personality and of psychotherapy are transmitted to the patient. Heine (**45**) reports a study of three different approaches to therapy in which the patients' subjective reports of the changes which took place within themselves all pretty much agreed, while there were sharp differences along "school" lines as to the theoretical explanation of these changes by the patients. Another possible conclusion from these studies is that psychotherapy is, to a large degree, teachable. To the extent that a therapist is aware of the reinforcing effect of his own behavior, to that extent he can with deliberation set out to modify verbalizations in the directions his approach teaches.

Winder (**108**) has relevant comments on the possible extrapolations of Verplanck's (**101**) study to psychotherapy:

> While there are several experimental shortcomings which are noted by the author, it is interesting to speculate from these results. One line of thought would consider psychotherapy as a complex and not always efficient conditioning process in which the patient learns to talk differently and little else. Another line of speculation not tested by the experiment is that while there are orderly changes in verbal behavior, the essential correlates are changes in the patient's perception of himself as a result of the fact that someone else spends time with him, takes what he says seriously, and shows him respect. Or, one might suppose that reorganization of verbal behavior would be accompanied by substantial modifications in other behaviors, especially those which are talked about. The methodology holds promise for investigations of psychotherapy-like situations and as one method of analyzing psychotherapeutic process.

One aspect of the results thus far will probably need much greater clarification. Do *S*s really learn without awareness of what is taking place? Dollard and Miller (**19**) cite Greenspoon's (**40**) experiment as strong evidence that there takes place in the therapy process learning that is "direct, automatic and unconscious." It is certainly difficult to argue with the results that only a handful of *S*s in these studies became aware of the learning nature of the situation. Some of the writers feel that perhaps the measures used to test "awareness," the open-ended questionnaires, are inadequate or not sensitive enough to pick up the "awareness" when it really does exist, or even different degrees of "awareness." As an illustration we can cite an example of an *S* seen in a study now under way. During the second session of reinforcement, he spontaneously remarked that the examiner nodded his head every time that he referred to "mother." This was a clear cut description of the experimental procedure. This was followed by a complete dropping of "mother" refer-

ences in the remainder of these stories. Yet, in the interview at the completion of 25 sessions, he replied in the negative to all questions about noticing anything about the *E*'s behavior, or being influenced, or noticing changes in his own stories. On the basis of the questionnaire, we would have to say that there was no "awareness" on the part of this *S*. Yet he had previously spontaneously shown that he was quite aware of what was going on. It would seem reasonable to hypothesize that examiner behavior cues are more effective while the *S* is not aware that he is responding to them. However, as the *S* becomes aware of what behavior is desired of him, then his response is no longer "automatic" but he may or may not respond depending on his motivation, attitudes, and relevant personality variables. The whole area of "awareness" merits further exploration.

Finally, one might speculate as to where future research in this area might be directed. There seems to be an almost unlimited number of ways in which conditioning verbal behavior as a technique for systematically exploring the variables of interpersonal situations can develop. The following are some of the questions which can be posed for experimental answer: Under what conditions are nonverbal cues such as smile, head nod, body movement more effective than the usual verbal cues?; For what type of verbal responses are minimal verbal cues such as "mmmhmm" more effective than the conventionalized verbalizations such as "good"?; What are the personality variables which distinguish a good verbal conditioning *S* from a poor one?; Is there a hierarchy of behavioral cues with respect to degree of effectiveness?; What are the personality correlates of being "conditionable"?; Is being "conditionable" a general personality variable or highly specific to the particular response involved?; Is there a difference in classes of verbal behavior for which one individual is conditionable?; How much generalization takes place from the verbal conditioning situation to verbal and nonverbal behavior in other situations?; Are there personality variables or chance factors which determine whether or not a given *S* becomes "aware"?; What are the personality variables which determine whether or not an *S* will "condition" once he has become "aware"?; How would the use of chemical agents such as tranquilizing drugs affect conditionability?; What are the parameters of counter-conditioning?; Are there lawful relationships between rates of reinforcement and changes in response rate?; What is the relationship between "conditionability" and emotional illness?; Are some reinforcers more effective, and are some classes of verbal behavior more easily conditioned in well-adjusted *S*s as against emotionally disturbed individuals?

In concluding, one could draw interesting, even frightening, implications of these studies about the control of human behavior. "Verbal conditioning" techniques might be Riesman's (**78**) "other directedness" with a vengeance, or could well be used as "hidden persuaders" or as "brain washing" techniques. However, there should be caution at this point. One is controlling behavior with the simplest and yet most complex and subtle of behavior cues. Perhaps these studies are getting at nothing more than what everybody knows—people control and manipulate each other by word, gesture, smile. What these studies do clearly demonstrate is that the basic vari-

ables of interpersonal processes can be studies under carefully controlled conditions. Verbal behavior is amenable to experimental analysis. In so doing, psychological science has taken another large step forward in developing techniques of investigating the complexities of human behavior.

SUMMARY

1. Thirty-one articles reporting studies of the conditioning of verbal behavior were reviewed in terms of setting, verbal responses, reinforceing stimuli, populations, controls, length of sessions, relationships to personality variables, results, and "awareness."

2. The majority of the studies report positive results with the use of generalized conditioned reinforcers such as "good" and "mmm-hmm."

3. The studies reviewed demonstrate that general principles of learning can be fruitfully applied to the experimental analysis of verbal behavior.

4. Some implications of verbal behavior studies for understanding and controlling the basic variables of interpersonal processes are discussed.

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THE HOROPTER IN EIDETIC SUBJECTS

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The purpose of the present paper is to establish exactly what has been shown concerning the shape of the horopter in eidetic individuals. No new experimental data is presented; the examination is only of earlier experimental studies on this issue. If some relationship should be found between the horopter and eidetic imagery, it must directly influence whatever explanations of these two phenomena we may propose.

The shape of the horopter in noneidetic *S*s is usually reported as in Fig. 1*A*. Taking the observer as reference, the horopter curve is concave for near distances, straight for intermediate distances, and convex for far distances. For the sake of simplicity, we shall accept this general pattern, though it has been shown that this may be simplistic because of inadequacies in experimental methods (**1**).

The work with eidetic *S*s seems to be confined to two studies (**2**, **3**). On the basis of this work, it was reported, and is still so quoted in the literature (**4**, p. 23; **5**, p. 247), that the pattern of horopter bowing is reversed, as in Fig. 1*B*. For eidetic *S*s, it is stated that the horopter is convex for near distances, straight for intermediate distances, and concave for far distances.

The question of horopter criteria is not now at issue. We shall take it that the criteria used in these experiments are valid.

The only point, then, is to examine the contention of the reversal in shape. In view of the lack of any accepted physiological explanation of the eidetic phenomenon in the first place (**6**, **7**), in addition to our uncertainty as to the shape of the horopter

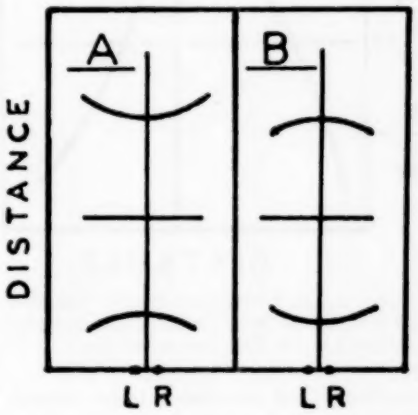

FIG. 1. THE EMPIRICAL HOROPTER. *A*. NONEIDETIC OBSERVERS. *B*. EIDETIC OBSERVERS.

curve even in noneidetics (**1**), it is extremely difficult to devise some experimentally accessible hypothesis as to why this reversal should occur.

It seems to me that if we wish to entertain a retinal explanation of the bowing of the horopter in noneidetic *S*s (for example, according to the Hering-Hillebrand theory of retinal asymmetry), perhaps we had best also entertain a retinal explanation for its reversal in eidetic *S*s.

To my knowledge, however, no connection between eidetic imagery and retinal physiology has yet been established.[1] Moreover, it is highly

[1] The horopter is traditionally defined as the loci of points, in physical space, whose images fall on cells in the two retinas which have a final common path in the brain. Such points are said to be "corresponding points," because these images "fuse" and are seen as single. One of the classical psychological criteria of the horopter, introduced by Ewald Hering in about 1879, is that of the "apparent-frontal-parallel-plane." Though this criterion

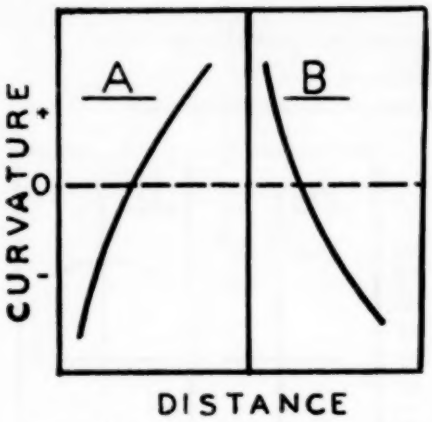

FIG. 2. THE CURVATURE OF THE HOROPTER AS A FUNCTION OF DISTANCE. *A*. NONEIDETIC OBSERVERS. *B*. EIDETIC OBSERVERS.

unlikely that any link between eidetic imagery and exclusively binocular phenomena (such as the horopter) will ever be shown—unless both events can be ascribed unambiguously to the brain.

Yet, a recent trend does exist towards cortical explanations of horopter bowing (**9**), perhaps in terms of a hypothetical geometry of the cortical (Cyclopean) fusion area. So that it becomes all the more important to examine the horopter of eidetic *S*s in order to re-evaluate a possible relationship at this higher neural level.

METHOD OF ANALYSIS

As is typical of horopter experiments, three or more rods, strings, or light-points are presented to the *S*, against a homogeneous background. In the ideal case, only binocular cues are available. The *S* moves (or directs the movement) of either the center rod or the two outside rods until the three rods appear to him to be in a straight line. Various restrictions concerning eye movements are generally included as controls. The head is always fixed.

Since we are concerned only with the bowing of the horopter as a function of distance, and not with its intrinsic shape per se, we can conveniently present the data in graphic form. For this purpose, we fit a circle through the three points, i. e., through the relative positions of the strings with respect to the observer, and compute the inverse of the radius of this circle. This parameter is generally called "curvature" and is designated by the letter K. We plot our graphs such that K (in inverse millimeters) is the ordinate, and distance (in meters) is the abscissa. We choose a sign convention so that the concave horopter gives $K<0$, and the convex horopter gives $K>0$.

For the straight horopter, at the abathic distance,[2] the radius of curvature is infinite, hence the curvature is $K=0$. Thus, the classical picture for noneidetic *S*s appears as in Fig. 2*A* and that for eidetic *S*s appears as in Fig. 2*B*.

ANALYSIS

Jaensch and Reich (**2**) presented data for 10 *S*s. The outside strings were 10 cm. apart, the center string was midway between them. All strings were 0.4 mm. thick.

The center string was first placed in an objective straight line with the outside strings. For all distances, except the abathic, it thus appeared to be out of line when first viewed by the *S*. The *S* then instructed *E* to move the center string forward or

is now suspect (e.g., **1**), it is the one used in the studies which we are examining here, and we shall accept it for the present.

[2] This is a term gaining popularity in the field. It refers to that distance at which the horopter is straight, i.e., without depth (abathic).

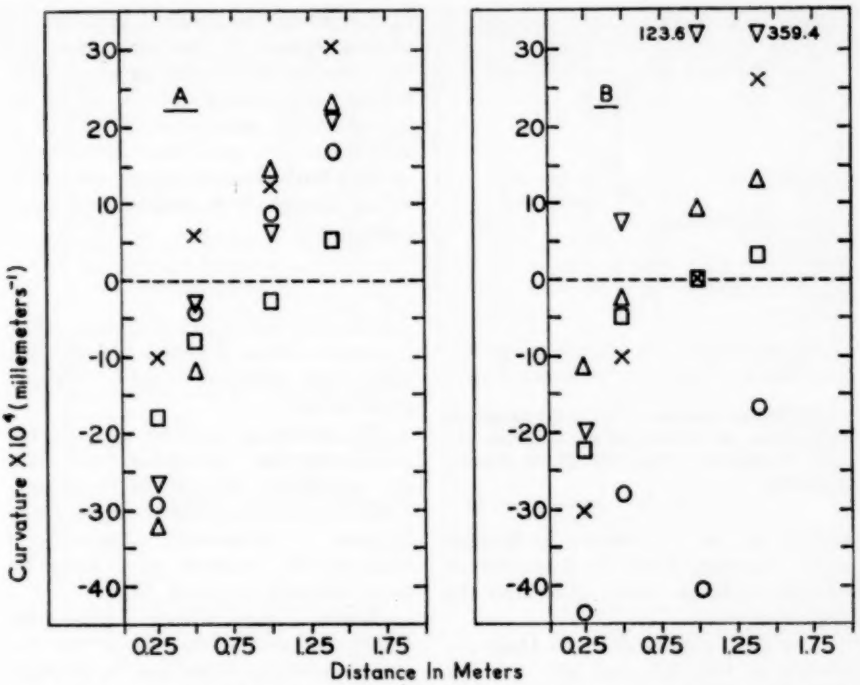

FIG. 3. THE EMPIRICAL CURVATURE OF THE HOROPTER, AS REPORTED BY JAENSCH & REICH (2). *A*. NONEIDETIC OBSERVERS. *B*. EIDETIC OBSERVERS.

back, until the three strings appeared to lie in a straight line.[3]

The *S*s fixated the center string at all times. It should be emphasized that this must have meant that true fixation was not maintained. The *S*s must have moved their eyes while they followed the motion of the center string forwards and back.

The data reported by Jaensch and Reich (2) are recomputed in Fig. 3*A* (noneidetics) and Fig. 3*B* (eidetics), where the observers are differentiated by symbols.[4]

[3] "Sie sind zunächst objektiv genau in eine Ebene eingestellt, und die Vp. hat anzugeben, ob etwa der mittlere Faden vor- oder zurückstehe" (2, p. 292). "They were first placed exactly in an objective plane, and the subject indicated whether the center string stood in front or in back."

Considering the spread of individual differences (that for eidetics, all of whom were quite young, is especially great), it does not appear that a distinction between eidetics and noneidetics can be made on the basis of this data.

The other experiment, by v. Hofe (3), employed only two *S*s. These were v. Hofe himself, as noneidetic, and a woman, presumably his wife, as eidetic. The procedure and apparatus were modeled after that of Jaensch and Reich (2). However, it is not entirely clear whether v. Hofe held his eyes rigidly on the center

[4] Jaensch's other work on his afterimage continuum and on dark-adaptation (8) is, I believe, somewhat in disrepute (cf. Husén).

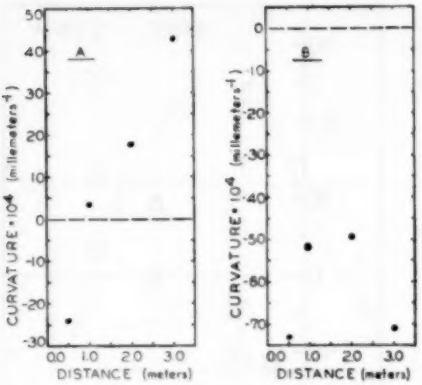

FIG. 4. THE EMPIRICAL CURVATURE OF THE HOROPTER, AS REPORTED BY V. HOFE (3). *A*. A NONEIDETIC OBSERVER. *B*. AN EIDETIC OBSERVER.

string, or not. Probably he himself used a moving gaze. It is stated explicitly that his other *S* fixated the center string.

The data reported by v. Hofe are shown in Fig. 4*A* and 4*B*. In this case, there is certainly a very real difference between the two observations, the eidetic *S* does not have an abathic point. We may recall that Jaensch and Reich also reported an eidetic *S* with no abathic point (*S* =O, Fig. 3*B*).

However, in 1921, five years before v. Hofe, Kröncke (**10**) had already reported at least six separate observations taken from three different noneidetic individuals which gave bowing patterns very similar to those shown by v. Hofe's and Jaensch's and Reich's eidetic *S*s.[5]

Hence, we must conclude, in spite of the wide discrepancy between v. Hofe's observers, that even this can be absorbed within the sway of individual differences which may be found among noneidetic *S*s. There is no evidence to show that the absence of an abathic point occurs with unequal frequency in eidetic and noneidetic *S*s.

[5] Kröncke's data is not given in exact quantitative form, so that it cannot be presented here for comparison. See, in particular, Kröncke's Figs. 13, 14, 23, 24, 33, 34, 35, 43, 44, and 45. Moreover, Kröncke's own discussion of eidetic responses is entirely qualitative.

CONCLUSIONS

We may conclude, therefore, that no relationship between eidetic imagery and horopter bowing has yet been shown.

The horopter bowing pattern for eidetic *S*s does not differ from that for noneidetic *S*s. That is, it particularly does not bow in an opposite manner. Moreover, observations without the abathic point may be found in both types of *S*s.

Hence, explanatory principles which are invoked to account for the one phenomenon need not be invoked to account for the other.

In particular, those formulations which have been developed in the past to relate eidetic imagery to horopter bowing (e.g., certain aspects of Jaensch's typology) may be considered irrelevent.

We are thus free, now, to examine the two phenomena independently, on any neurological level we may wish.

SUMMARY

Two early studies were examined critically. These studies are often cited as showing that eidetic *S*s give a pattern of horopter bowing, as a function of distance, which is the reverse of that shown by noneidetics. It has been shown that this is not correct. In fact, the horopter bowing pattern for eidetics lies well within the range of individual differences

displayed by noneidetics. This applies equally well to the absence of an abathic point.

Horopter phenomena and eidetic imagery may therefore have entirely independent physiological bases.

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